THE AEROPLANE

Incorporating
Aeronautical Engineering
Edited by - - THURSTAN JAMES

Founder and First Editor
(1911-1939), C. G. GREY

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THE WEEK IN AVIATION

WITH remarkable unanimity newspapers and periodicals last week accorded to the report of the court of inquiry presided over by Professor D. T. Jack a generous slice of space for report and comment. The remoteness of this report from those normally considered in our pages is shown by the fact that the court was constituted by the Minister of Labour and National Service. However, even those of us most inexpert in industrial affairs will have read with deepening wonder the account of the extraordinarily complex structure of committees and panels through which management and workpeople, employers and employed, communicated with each other in the B.O.A.C. shops at London Airport. And in industrial relations, as in most other lines of activity, the more complex the lines of communication, the more difficult it is to ensure smooth and economical working.

The report had not been published long before statements issued by various parties made clear the fact that its recommendations were not going to be accepted without further struggle. Yet it is obvious that without a great deal of improvement in internal communications really robust good health within the Corporation is not to be expected. It seems the generally accepted view that the appointment of the two new directors should go far towards bringing this about. Yet we have a responsibility to report the widely held view that useful though the new directors' experience should prove, an access of practical airline engineering experience to the B.O.A.C. board would be better still.

We, in this issue, on the other hand, have devoted a generous proportion of our space not to the industrial troubles of our nationalized airline, but to the latest product of our private enterprise industry. Whether or not the Vanguard will have flown before these words are read is not certain; the maiden flight seems likely to be shortly after our publication date.

The advent of the Vanguard is certain to play an important part in the well-being of the British aircraft industry and indeed of the airline systems of the World. But there is plenty of work still to be done. The flight test schedule requires 1,600 hours of flying and its culmination in the granting of a full British C. of A. is planned for March, 1960. To get this done in the time involves the use of four B.E.A. aircraft as well as Vickers' own prototype. This is further illustration of why the aircraft industry sees no easy way of financing and developing aircraft out of its own resources. Nor is the process of developing a new aircraft a speedy one. By the time the C. of A. is forthcoming in March, 1960, it will be eight years since discussions between B.E.A. and Vickers took place concerning the embryo of the Vanguard.

This question of developing aircraft is one unceasingly in mind in the industry. The generally accepted line of thinking in this matter was well put by Mr. E. C. Bowyer in a talk before students and graduates of the Royal Aeronautical Society last week. He gave it as his personal view that on the issue to the industry of a specification for a large new freighter aeroplane able to meet modern Army and Air Force requirements depends literally our future in export trade in aircraft of this type for civil and Service use. Earlier in the talk he had enlarged upon the help which could be given to the industry if a positive policy were to be adopted of bringing in Transport Command of the R.A.F. to help in the development flying of transport aeroplanes. An example of such co-operation has been the tremendous amount of flying done by Transport Command with the Comet 2.

In the course of his same talk Mr. Bowyer had something to say about the importance of nationally sponsored aeronautical research. So did Sir George Edwards in moving a vote of thanks to Mr. Eric Mensforth after the third Cantor lecture last week. Sir George warned his audience if something were not done by the Government without further delay it would be too late. In this connection we would remind our readers of the views so cogently expressed by Sir George and others at Derby recently following the giving of the Sir Henry Royce lecture.

These points are not so remote as they may at first seem from the note on which we began this discourse. If it be true that evil communications corrupt good manners, it is no less true that they corrupt good engineering. Good engineering whether in the design office, the production factory or the maintenance shop, lies at the root of Britain's supremacy in the air.

To All Our Readers

A MERRY CHRISTMAS

MATTERS OF MOMENT

Enter the Vanguard

WITHIN a few days of these words being read, the prototype Vickers Vanguard propjet airliner should have made its first flight from the manufacturers' headquarters airfield at Weybridge. In this issue is a 17-page supplement giving the first detailed survey of the principal structural features and background of this important new British aircraft, together with a specially enlarged cutaway drawing and a note on the development of the Rolls-Royce powerplants.

At the time of going to press, the Vanguard's four Tyne engines had been cleared for flight by the Rolls-Royce engineers and the aircraft was undergoing the many checks and double checks of the systems and services that are necessary prior to the final exhaustive inspection before the first flight itself. According to Jock Bryce, the company's chief test pilot—who will be accompanied on the maiden flight by Brian Trubshaw as second pilot—he will most likely fly the Vanguard on the same day that he does its initial taxi-ing trials.

The flight itself will be done at a restricted all-up weight of 90,000 lb. (the aircraft's normal maximum all-up weight is 141,000 lb.) because of the comparatively short runway length at Weybridge. The available run is 1,200 yards to which has recently been added a 250-yd. extension at a slight angle at the railway end of the runway. With this length of run available, incidentally, it is reckoned that speeds of up to 100 knots will be obtained with the Vanguard during the taxi runs.

The first flight is, in fact, to be no more than a ferry flight from Weybridge to Wisley during which only a preliminary assessment of the handling characteristics can be made. However, Jock Bryce plans to do a gentle circuit or two of Wisley before he makes his first Vanguard landing—so the flight should be more than a simple "hop."

The L.A.P. Dispute Inquiry

IT is not the custom of this journal to comment in detail on trade relations, even though these may sometimes be vital to the health of the aviation industry. The report*, published last week, of the inquiry into the cause of the B.O.A.C. strike of maintenance men, between October 13 and 21, can be purchased and was, in any case, comprehensively summarized in the newspapers.

The report blamed both sides, management and men—with the greater blame attached to the trade unions concerned—but did not comment extensively on the real problems behind the dispute, or on the fact that trouble within the nationalized airline industry has been going on for years. The cause of the unofficial strike in October goes back to June 3, 1958, when a still-pending wage-claim was advanced; the more immediate cause was a ban on overtime work (described by the report as without "constitutional warranty") and the threat of dismissal, or dismissal, of some of those who refused to work overtime.

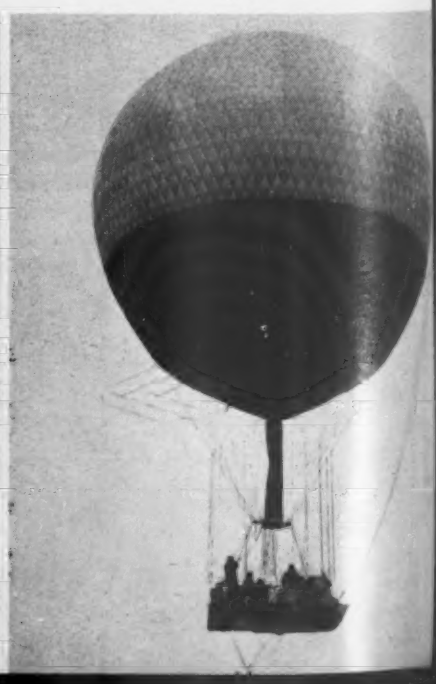
There is, however, little ambiguity in one sentence of the conclusions of the inquiry, which reads: "We have been forced to the view that in the past there has been inadequate responsibility and leadership at various levels on both sides and that this has given scope and encouragement to certain militant elements whose activities have brought discredit to the existing constitutional arrangements."

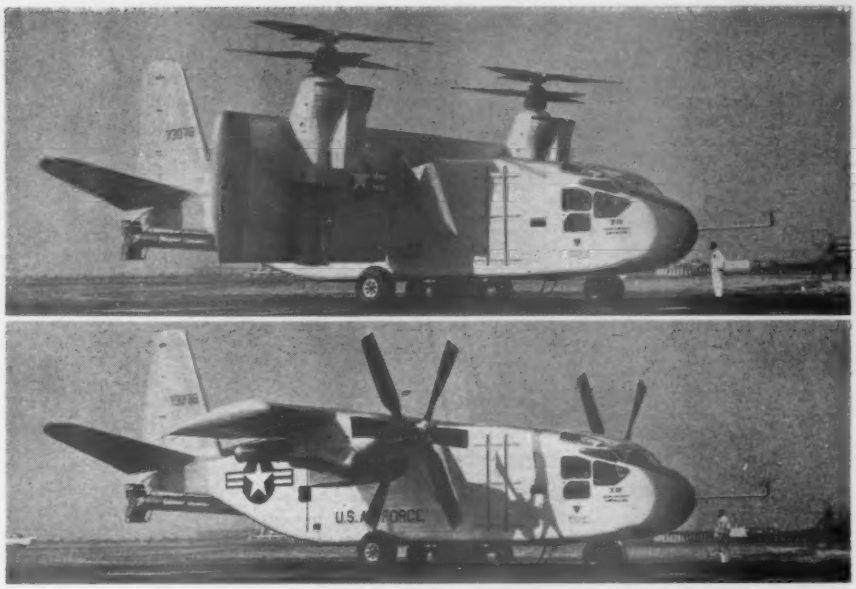
Following publication of the report changes have been approved by the Minister of Transport and Civil Aviation to the board of B.O.A.C.

Two new members have been appointed and one of these has been actively concerned with labour relations. They are Sir

* "Report of a Court of Inquiry into the causes and circumstances of a dispute at London Airport existing between Employers and Unions represented on the National Joint Council for Civil Air Transport." Published by H.M.S.O., price 2s.

PREMIER OCCASION.—After opening the Preston Motorway, the Prime Minister, Mr. Harold Macmillan, flew back by Silver City to London from Warton. There Mr. Macmillan, here seen with Viscount Caldecote (left) and Mr. R. P. Beamont (right) saw the English Electric Lightning.





HILLER HOVERER.—Soon to fly is the 33,000-lb. Hiller X-18 VTOL research aeroplane. It has a pivoting wing and is powered by two Allison T-40 5,535-e.h.p. coupled turboprops driving contra-rotating propellers. In vertical flight stability is given by "puff pipe" control at the tail supplied by a Westinghouse J34 turbojet in the fuselage. The fuselage is from a Chase YC-122 and the engines were originally used in the U.S. Navy tail-sitter "pogo stick" fighters.

Wilfred Neden, C.B., C.B.E., and Mr. Frank Taylor. Additionally, Mr. Keith Granville, C.B.E., the Corporation's deputy managing director, will join the board at the end of the year when Sir Francis Brake relinquishes his appointment in order to concentrate on the affairs of B.O.A.C. Associated Companies.

Sir Wilfred entered the Ministry of Labour in 1922 and has been Chief Industrial Commissioner since 1954 and until his recent retirement. He has, according to *The Times*, shown himself to be "a master of conciliation, combining toughness of fibre with a real understanding of the attitudes of all concerned. Nobody is better equipped to help bring about improved relations with the Corporation's employees."

Mr. Taylor founded the firm of Taylor, Woodrow in 1922, and has been its chairman and managing director ever since. He also has business interests in Canada. He is a member of the Council of the Export Group for the Constructional Industries.

Mr. Granville joined Imperial Airways in 1929, and has thus had nearly 30 years service with it and its successors. He became divisional manager, Africa and Middle East, in 1952, was appointed commercial director in 1956 and deputy managing director in January, 1958.

Drifting Over the Atlantic

UNDER the distinguished patronage of H.R.H. the Duke of Edinburgh an attempt to cross the South Atlantic in a free balloon from Medano in the Canary Islands near Teneriffe began in the early hours of December 12. The pilot, Mr. Arnold Eiloart, had been trained by Mr. G. Long at Cardington, in a home-built free balloon.

The balloon, named "Small World," is made of Terylene fabric coated with Neoprene. The volume is 54,000 cu. ft. The usual basket has been replaced by a 15-ft. by 8-ft. sailing boat designed by Mr. Colin Mudie, who is the navigator, his wife looking after the catering. Mr. Timothy Eiloart, Arnold Eiloart's son, is the radio man. The sailing-boat gondola, made of foam plastic, has been designed to stand up to rough weather, and should make a landing at sea quite safe, for the crew members are experienced yachtsmen.

If a flight of long duration is to be made, it is essential that ballast and gas be conserved, and all undesired variations in altitude be checked at once. Otherwise the balloon will get a run on her, and much more ballast and gas used to check her, so shortening the flight.

For the first time in balloon history, pedal-driven swivelling airscrews have been fitted, capable of a maximum vertical thrust of about 30 lb., when all the crew are pedalling. These should be extremely useful in checking small variations, caused perhaps by the sun playing hide and seek with the clouds.

When the balloon descends, it will be checked, unless the descent is very fast, by the weight of the tail rope being taken by the water. This is normal ballooning practice. There were to have been a series of sausage-shaped food bags hanging below the car, and beneath these again, a length of polythene tube weighing about 70 lb.

To replace ballast the intention is to pump up water from the sea. To replace up to about 15,000 cu. ft. of the hydrogen valved, 500 lb. of hydride charges for a hydrogen generator were to be carried.

There was a gusty wind at take-off, and it was only with great difficulty that the inflated envelope could be walked over to the boat car. There was, too, a language problem, for orders had to be translated into Spanish. Unfortunately it seems that when the car had been toggled on to the ring or hoop, Sqn. Ldr. Booth, in charge of the ground crew, had no chance of ballasting the balloon up before the take-off. This ballasting up, or weighting, is almost essential if a good ascent is to be made. The lift must be sufficient to enable the balloon to clear all obstacles.

In this case, apparently, perhaps owing to the darkness and wind, and possibly the number of willing helpers, Eiloart, once they were all aboard, decided to take off then and there.

The balloon was heavy, and came down again after some ballast was released. The ground crew were of course helpless, and the balloon dragged along the beach and out to sea, Sqn. Ldr. Booth yelling to them to throw out ballast. This they did, and at last they rose into the night sky.

According to the *Daily Mail*, they threw out as ballast, half of their chemicals for making fresh water, some of the calcium hydride for making hydrogen, and food reserves. It is to be

SAILING THE TRADES.—Inside the boat-like gondola in which they hope to cross the Atlantic from East to West beneath the balloon "Small World" Mr. Timothy Eiloart and Mrs. Rosemary Mudie are facing the camera. Back to the camera are Mr. Colin Mudie and Mr. Arnold Eiloart. The pedal-driven airscrews are to provide vertical thrust to conserve gas or ballast. They can also be used to generate electric power.

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hoped that the boat car was not damaged while bumping along, and that the swivelling propellers and batteries are in order.

What also seems rather serious is the fact that the crew had no proper rest for 40 hours, and this perhaps accounts for their hasty departure. At the time of writing, two radio messages have been received, stating that although they are tired, all was well and that they were drifting in the right direction.

The British long-distance record for a free balloon flight was made in 1908, when the late A. Gaudron, E. M. Maitland, and C. C. Turner flew from the Crystal Palace to Mateki Dervni in Russia. The distance covered was 1,117 miles, and they ended up by making a crash landing in a blinding snowstorm at night on a snow-covered lake.—VENTRY.

Appointment at Radlett

FOLLOWING the retirement of Mr. W. H. MacRostie after 40 years' service with Handley Page, Ltd., Mr. K. C. Pratt, A.M.I.Mech.E., A.F.R.Ae.S., has been appointed chief engineer.

Mr. Pratt joined the company in 1934 and has been associated with the development and production of many aircraft since then, including the Harrow, Hampden, Halifax, Hastings, Hermes and Victor. He has served in the experimental, mechanical-test and structural-development departments.

Since 1951, when he became test and development engineer, Mr. Pratt has been in charge of the Park Street works. He became deputy chief engineer two years ago.

Developments at Aberporth?

SKYLARK high-altitude research rockets may be launched from the missile range at Aberporth on the west coast of Wales. This was revealed by Dr. R. L. F. Boyd of the University College physics department in a lecture before the Radar and Electronics Association on December 3.

Launchings of this rocket have been made from a 80-ft. tower at Woomera; Dr. Boyd said that a similar tower had been built at Aberporth, but that permission for launchings from it had not yet been received. The Skylark is an unguided rocket designed to carry an instrument load of 100-150 lb. to an altitude of about 85 miles; later versions may achieve an altitude of more than 130 miles.

Operation Chimney Plumes

TWO flights over fog-bound London were made recently by a DC-3 of Fairey Air Surveys, Ltd., to find out whether the gases from London power-station chimneys penetrated the fog layer and escaped into the upper air. The flights were made in medium fog on October 28 and in the persistent fog of December 4; they proved that the chimney gases did in fact reach the upper air.

This project was undertaken for the Central Electricity Generating Board by the research department of Fairey Air Surveys, Ltd. The aim was to check the belief of C.E.G.B. engineers that the volume and heat of the gases was such that they would rise through the fog layer.

In planning the operation it was decided that the aircraft should be based at London Airport and take off in very poor visibility. It was fitted with Decca Navigator and Flight Log; special large-scale charts were prepared giving the positions of the power stations so accurately that separate chimneys could be plotted. Radio communication was arranged so that the aircraft could keep in touch with the main power station.

In the fog of December 4 the aircraft took off with about 50 yd. forward visibility. Over London the fog was 750-850 ft. thick, but it was found that plumes from power-station chimneys penetrated this belt; their positive buoyancy was shown by turbulence when the aircraft passed above the plumes. Particular attention was paid to the power stations at West Ham, Blackwell Point and Brunswick Wharf.

After the operation the aircraft made a dummy approach to London Airport to check the fog intensity; at an altitude of 200 ft. the forward visibility was nil and the high-intensity approach lights could not be seen. The aircraft was then diverted to the nearest open airfield, which was Guernsey.

Unfair Shooting

A CORRESPONDENT writes that in a recent TV programme he heard and saw a politician assert that "The R.A.F. still has no fighter plane that can fire its guns without the engine stopping." Understandably he condemns this as a piece of pre-General Election propaganda at the expense of the R.A.F. and the aircraft industry.

The more serious charge can be made that, if the statement were made, it is not true. As is well known, difficulty was encountered in this respect with regard to some fighters, but the trouble was cleared long ago. In any case, the Javelin, for example, experienced no trouble with its guns.

Firefly Follow-up

FOLLOWING our account, in THE AEROPLANE of November 28, of naval operations with pilotless Fireflies in connection with guided-weapons development, the Fairey Aviation Company has supplied some additional details of its radio-controlled drones. The remote-control system, the radio installation and the modifications to the autopilot in the original Firefly drone (a Mk. 7) were all designed by R.A.E. The aircraft was later "productionized" by the Fairey Aviation Company (Stockport) and renamed the U.8. During this process further modifications were introduced by the Fairey company to improve the handling under remote control.

When a further batch of 40 drones was ordered, based on the Firefly Mk. 5 fuselage, a flight-development programme was begun at Ringway. Fairey Aviation took over the responsibility for the autopilot and remote-control equipment from R.A.E., and extensive improvements to layout were made.

Much flight development work was necessary with the converted Mk. 5 aircraft (known as the U.9) since the aerodynamic characteristics differed greatly from those of the Mk. 7. The Firefly 9s were eventually delivered to Llanbedr where they have been operated with great success since October, 1957, by Short Bros. and Harland, Ltd.

Despite this success No. 728B Squadron at Hal Far found that extraneous factors not encountered at Llanbedr gave them unexpected difficulties in control during landing, and therefore developed a technique calling for a longer deck hook.

In the case of the prototype Firefly 9 the Fairey company performed take-off and landing trials under remote control at Llanbedr. All production aircraft are put through the complete range of remote-control demands before delivery. This is done by means of equipment, carried in the rear cockpit, which simulates the commands normally received by radio. Similar equipment is used by Llanbedr and No. 728B Squadron to check flight behaviour and to set up the various attitudes and responses before an aircraft is "sent pilotless."

Last week, the Air League announced that in view of the overwhelming opposition expressed from all sides of the aviation world to the proposed design of the R.34 memorial, the Council of the League had decided not to go ahead with the project.

Eagle's Cheap-fare Bid

LAST Monday Eagle Airways made initial application to the Air Transport Advisory Council for permission to offer normal passenger services to a number of Colonial destinations at fares which are about half those normally charged to tourist passengers. High-density-furnished DC-6As, or similar aircraft, would be used and operations could start with limited (weekly and fortnightly) frequencies on March 1, 1959. The proposed destinations include Malta, Singapore, the Bahamas, Jamaica and Trinidad, Nigeria and Kenya—all of them cabotage services requiring only U.K. and Colonial Government approvals.

We hope to deal with some of the pros and cons of the proposals in a later issue. The obvious points of objection by the A.T.A.C. and competing operators would concern the relative standards of the service, the fact that such low-fare services might divert traffic from those already operating and the soundness of the economics of the proposal. The proposed fares are, in fact, higher than those charged, say, by Pan American and Eastern (2.4d./st. mile) on their coach-class services between New York and San Juan, Puerto Rico. Our view is that only by vigorous action of this kind can we hope to see the really competitive reductions in air fares which will reach a new air travel market.

Hypersonic Discussion

CURRENT knowledge of hypersonics was surveyed on December 15 at an all-day discussion organized by the Royal Aeronautical Society. The meeting was under the chairmanship of Dr. G. W. H. Gardner, director of the Royal Aircraft Establishment. Eight short talks averaging about 20 min. each surveyed various aspects of hypersonic flow, gas physics, re-entry problems and electro-magnetic propulsion systems; some three hours were devoted to discussion from the floor.

Hypersonics are still to a large extent of academic interest in Britain—this was shown by the fact that all the lecturers were either from research establishments such as the R.A.E. and N.P.L. or from Universities. But the industry was well represented in the audience of more than 200 people.

Although several papers dealt mainly with theoretical work on hypersonics, others gave an idea of the trends in practical work. For example, Dr. D. W. Holder, of the N.P.L. aerodynamics division, surveyed the facilities necessary to the model-testing of a ballistic missile with a range of 6,000 miles. He also suggested that there should be research on future requirements, so that suitable hypersonic test facilities could be designed.

A call for an emphasis on research which would be of practical use in the engineering design of hypersonic vehicles was made by both Dr. D. Kuchemann, of the R.A.E., and by Mr. G. H. Lee, of Handley Page, Ltd.

An interesting paper by Mr. A. T. F. Nonweiler, of Queen's University, Belfast, discussed the launching and re-entry of manned satellites. He showed that the most critical re-entry conditions were likely to arise if the vehicle had to make an emergency re-entry after an abortive launching.

NATO Missiles

AS a kind of hors d'œuvres to the series of NATO meetings in Paris, there was staged in that city last week, so it is to be believed from Press reports, a display or exhibition of British guided missiles. The object of the exhibition, which was handled by the Ministry of Supply, was to demonstrate to our NATO allies what our industry has been and is doing.

It also seems that the manufacturers were not able to be present at the exhibition nor at the talks which were given by departmental representatives. This, if true, must certainly make the selling of such products even more difficult. Customers are notoriously unsympathetic to sales talk at second-hand.

Equally, the absence of the manufacturers' representatives would hardly seem to be in accord with the Government's stated readiness—according to the Ministry of Supply—to facilitate production on the Continent of any of the weapons discussed at this NATO meeting or to enter into joint projects for developing and producing more advanced versions.

B.O.A.C. DIRECTORS.—As noted on page 879, two new directors have been appointed to the board of B.O.A.C. following the publication of the report on the inquiry into the dispute at London Airport. They are, left, Sir Wilfred Neden, and, right, Mr. Frank Taylor.

Solid Propellents in Britain

POSSIBLE British production of the American Polaris submarine-launched missile has been suggested following the announcement of the formation of Bristol-Aerojet, Ltd. (THE AEROPLANE, October 17) by the Bristol Aeroplane Co., Ltd., and the Aerojet-General Corpn. of California.

While this is not out of the question, it is doubtful whether there is at present any serious intention to make the Polaris here. Bristol-Aerojet was formed to meet the increasing needs for solid-propellent missiles. Bristols have for some time produced such rockets and make cases for most of the British guided weapons using these units, including the Raven research vehicle and various anti-tank weapons.

An important outcome of the new link-up is that the latest Aerojet propellents will now be available here. One of these uses polyurethane foamed plastic, the voids in which are filled with some oxygen-rich material such as potassium or sodium chlorate, or a solid peroxide.

Solid propellent is extruded or cast in the manufacture of missile charges and until recently the diameter has been restricted because of cracking as the extrusion dries out. Use of a plastic such as polyurethane avoids this difficulty and allows the making of large-diameter charges big enough for ballistic weapons such as the Polaris and Minuteman.

Jane's, 1958-59

IN its 1958-59 edition, "Jane's All the World's Aircraft" was published yesterday. Once again, the compiler and editor, Leonard Bridgman, and his assistant compiler, J. W. R. Taylor, have spread their net wide to make the contents justify the title of *all* the World's aircraft. Despite considerable deletion of obsolescent material (which has already appeared and can be quickly located using the 10-year index in this volume) the new edition is longer by 44 pages than last year's edition.

One reason for the extra length, and a welcome one, is the inclusion for the first time of a full-scale Missile Section, in which all the World's current guided missiles and test vehicles are described and illustrated in conformity with the standard presentation in other sections. Thus 36 pages of missile catalogue replace the seven-page table included last year.

In the aircraft section, too, there is further evidence of the policy of giving full coverage to the lesser-known—and, admittedly, less significant—products of small companies and even amateur builders. It is a tribute to Jane's reputation and the persistence with which the compilers pursue their task, that much material appears here for the first time anywhere; of particular interest in this respect is the Argentinian I.A. 38, a 45,000 lb. tailless cargo transport designed by Dr. R. Horten and soon to fly.

In all respects, the newest "Jane's" will make a welcome—if weighty—addition to the Christmas stockings of aircraft engineers and students throughout the World.—F.G.S.

News of Aircraft, Engines and Missiles

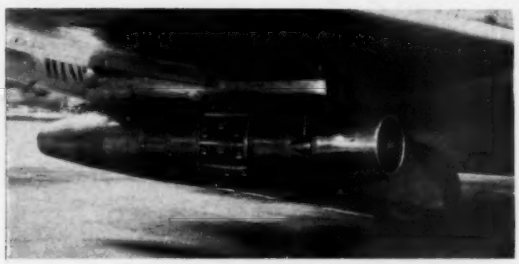
WESTMINSTER END.—The voluntary liquidation of Westminster Airways Servicing, Ltd., and of its associated companies, Light Engineering Designs (Gosport), Ltd., and British Industrial Model Services, Ltd., as from December 9, is announced. Premises and plant at Hardway, Gosport, have been sold to Hydro-Pneumatics, Ltd., of Egham, Surrey, which firm will continue to undertake, with the existing staff, all outstanding commitments.

NEW HERCULES.—The first of the Lockheed C-130B Hercules military transport aircraft has made its first flight. This new version has four Allison T56-A-7 turboprops which give a speed of 360 m.p.h. and an operating height of more than 35,000 ft. The range is 4,000 miles, 1,000 miles more than the earlier Hercules, and the take-off weight is 135,000 lb.

MISSILE MONKEY.—After surviving a 1,700-mile flight in the nose-cone of a Jupiter IRBM, a squirrel monkey was lost in the South Atlantic when the nose-cone recovery gear failed to operate.

NEW JODEL.—Series production of the S.A.N. Jodel D.140 Mousquetaire has just begun. This four-seat aircraft is seen here (right) with a D.117, the flight characteristics of which are discussed on pages 904-5.

DC-8 TESTING.—Trials with the first (JT-3C powered) DC-8 have covered "the entire operating range of the aeroplane, including a speed of 600 m.p.h. and an altitude of 39,000 ft." Referring to the first take-off in the second (JT-4A powered) DC-8, the test pilot, A. G. Heimerdinger, said "the instant response of these powerful J75 engines exceeds anything I have ever known in all my flying experience."



TURBOJET TEST.—The Armstrong Siddeley Viper ASV.3 for the Jindivik target aircraft has completed flight-testing up to 55,000 ft. under the starboard wing of a Canberra. A Napier de-icing mat is used to absorb the current produced from the 6-kW. generator mounted on the engine. The ASV.8 and ASV.11 turbojets will be similarly tested.

CONVAIR ROLL-OUT. — The first Convair 880 was to be rolled out of the final assembly shed at San Diego last Monday, December 15, and is expected to fly at the end of January.

CANADIAN DELIVERIES. — Canadair, Ltd., have delivered their final production Sabre, which was the 1,815th to be built in Canada, and completed the F-86 order for the Luftwaffe. The Canadair T-33 production line is due to close in January, 1959, with completion of the 650th Silver Star, and the company will then concentrate on the CL-28 (of which 33 are on order), CL-41, CL-44 and CL-66. The R.C.N. now has all 39 of its F2H-3N Banshees, and 43 D.H.C. Trackers had been delivered before production of an improved version was initiated.

KOLIBRIE VALIDATED. — The Netherlands Helicopter Industry N.V. has reported that the British A.R.B. is now prepared to validate the Dutch C. of A. for the Kolibrie H-3 ramjet helicopter for operations under U.K. registration. The Board felt that the normal reciprocal arrangements for airworthiness validations between the British and Dutch Governments were inadequate in the case of the Kolibrie, which is the first civil ramjet vehicle, and a survey was therefore made by two A.R.B. representatives at the N.H.I. works in Rotterdam. The first U.K. registered Kolibrie is owned by the British agents, European Helicopters, Ltd., of Ipswich. A flight assessment of this helicopter appeared in THE AEROPLANE of December 5.

FRONT FAN.—Pratt & Whitney JT3C-7 turbojets can be converted to JT3D-1 turbofan standard. The first three stages of the L.P. compressor are replaced by a two-stage fan; the second-stage L.P. turbine is enlarged and a third stage added to drive the fan; and water-injection is added to the diffuser case. These changes give 140% more air mass flow and 26% less jet velocity. Static sea-level thrust of the JT3D-1, due for production in November, 1960, is 16,000 lb. up to 60° F. ambient temperature with water-injection. Specific fuel consumption is 0.78 lb./lb./hr. maximum cruise-thrust at 35,000 ft. and M=0.82.

STUDYING STRATEGY.—An international organization for the study of defence and disarmament has been founded in London. Known as The Institute for Strategic Studies Limited, it has been financed initially by the Ford Foundation of New York. The purpose of the Institute is to provide a focus for the study and discussion of the effect of political and scientific development upon strategy, upon Western defence policies, and upon disarmament plans. Among the founder council members are Marshal of the R.A.F. Sir John Slessor and Air Chief Marshal Sir Ronald Ivelaw Chapman.

STAND-OFF BOMB. — Hawker Siddeley have stated that inertial guidance is used for the Avro stand-off bomb, which will be carried by the Victor and Vulcan.

JET DISTANCE RECORDS.—The F.A.I. has confirmed two records for distance in closed circuit (Group I): Capt. C. E. Gibbs, U.S.A.F. (pilot) and Lt. D. E. Shartzer, U.S.A.F. (co-pilot), Boeing KC-135 Stratotanker (four Pratt & Whitney J57-P-43), Spokane-Hoquiam-Spokane-Washington, September 17, 1958, 5,026.9 km.; and Lt.-Col. V. L. Sandacz, U.S.A.F. (pilot) and Capt. K. G. Wolf, U.S.A.F. (co-pilot), Boeing B-52D (eight Pratt & Whitney J57-P-19), at Ellsworth, September 26, 1958, 10,032.64 km.

SWEDISH ROCKET. — Svenska Flygmotor has developed the VR3 rocket, which has 5,700-lb. thrust at 65,000 ft. It uses HTP oxidant and kerosene fuel. Flygmotor also made the 200-Series Rolls-Royce Avon and their own design of afterburner for the Saab Draken. It is fairly certain that the new rocket is to improve the Draken's performance at take-off, in transonic flight and at great heights.

LOBBER. — A small cargo missile known as Lobber has been developed by Convair. It is designed for carrying supplies to troops at isolated outposts, and will carry a 50-lb. payload over a range up to six miles.

MORE NEWS ON PP. 911-12

TAIL TUG.—Seen here braking a B-26 Invader, this Vortex Ring parachute equipped with sail-like cloth blades that spin, has been developed by Mr. D. T. Barish, a New York aeronautical engineering consultant. It is adaptable for paratroop and cargo dropping and missile recovery as well as aircraft braking and will be produced and marketed by the Pioneer Parachute Co

Air Transport

Cleaning up the Flight Deck

EVEN if no single group among airline pilots, test pilots, the airworthiness authority, manufacturers and operators had agreed with any of the others, last week's Flight Deck Forum (organized as a day's discussion by The British Air Line Pilots Association) would have been worth while; each group would at least, have learnt to understand something of the problems faced by the others. In fact, there was a considerable measure of agreement and the differences, where marked, were primarily concerned with ways and means.

The basis of the discussion was BALPA'S recently formulated policy for flight decks. This policy was offered so that an agreed series of requirements could be available to manufacturers and was principally concerned with the most critical of layouts—that for two-crew operation. The comments at the meeting covered much wider requirements, however, and dealt with philosophies as well as with details.

No attempt will be made in this commentary to pick out the authors of the different views expressed except in the cases of four whose contributions seemed, to the neutral observer, to provide the main pattern. These were Capt. P. E. Bressey, technical representative of BALPA, and Wg. Cdr. W. F. Gibb, chief test pilot of Bristol Aircraft, who gave the two talks; Capt. D. S. Kirkland of B.E.A.; and Mr. D. P. Davies, chief test pilot of the Air Registration Board. All four, it should be stressed, were often speaking as individuals and pilots rather than as representatives of one organization or another. Which was as it should have been.

Before dealing with some of the many points raised during the discussions it might be as well to remind ourselves that the cockpit-layout problem has always been with us—the only difference is that it has become more critical. During the introductory comments at last week's meeting it was suggested that the transition between the simple and the complicated control cabin came during the last war when no organized agreement on standards was practicable.

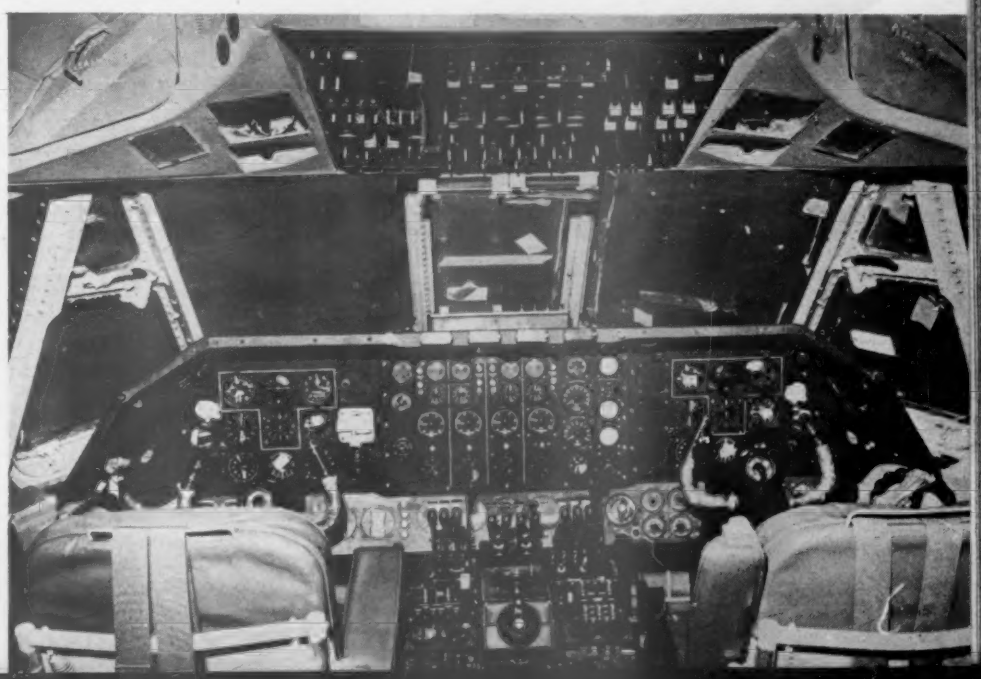
That may well be so—but at least we had, in those bad old days, a standard flight panel in all British aeroplanes. The other instruments and controls may have been littered all over the place—some of the vital ones, as in the early Blenheims, actually behind one's back—but the flight panel remained central and unaltered. Those of us whose job it was to test or to ferry dozens of types even found comfort in the fact that different aeroplanes had, otherwise, very different layouts and were mildly dismayed by the ordered (but still individualistic) tidiness of American aeroplanes such as the Hudson and Liberator. We actually preferred the British muddles, even when these involved gymnastic contortion with layouts which would never, today, be approved by the airworthiness authorities.

The lessons here may be that, so long as the position and appearance of vital instruments and controls are fairly rigidly standardized, the layout of the others is of no great importance, and that, when a pilot is flying different types in a fleet, generally similar layouts are more difficult and prospectively dangerous than those which are utterly dissimilar.

But, although the simplification and standardization of instruments and controls were discussed at the BALPA meeting, the main initial attack by the pilots was directed at the poor (and possibly dangerous) living conditions on the flight deck. Capt. Bressey, for instance, in a humorous (and therefore inevitably effective) opening broadside, spoke of tribulations, caused by a careless or thoughtless design feature, which could be actively dangerous. The disappearance of a pair of dividers through a hole in the flight-deck floor was irritating, but how might these dividers be faring amongst the assorted and fairly vital machinery down below? Paraphrasing his comments still more inaccurately, but following the general line of his attack, one might say, for instance, that a Douglas protractor was admirably designed for the purpose of scraping ice off the inside of the windscreen panels; that the contents of a pilot's briefcase should include a folding umbrella which could be opened and raised at the start of the let-down as protection against the showers of water as thawed ice and condensation ran downhill; and that, on the flight deck, the pilots either fried or froze. At what point could discomforts become dangerous?

Some of the facts which emerged from the talk were: that cockpit floors should not have holes and that flight decks should not be dirt-traps; that things like ADF tuning dials should be conveniently placed; that bad detail design features should be modified quickly; that the flight deck should be adequately air-conditioned and that radio equipment should be ventilated; that something should be done about channelling the water which collected in pressurized aircraft; that screens should be more adequately heated; that there should be lighting and support for let-down charts; and that more thought should be given to the basic positioning of instruments and controls according to their importance and periods of active use.

Wg. Cdr. Gibb stressed the need for the manufacturer to know flight-deck requirements years in advance. He cited the case of the Britannia which, at B.O.A.C.'s request, was arranged without a flight engineer's station and then, at the eleventh hour, had to have one included. He believed that a flight engineer's station was essential and that, pending a better rule, the firm U.S. requirement (that an engineer's station should be provided in all aircraft with a maximum weight of more



MODERN CONTROL CABIN.—This picture of the Vickers Vanguard flight deck is especially interesting in connection with the BALPA meeting which is the subject of the accompanying article. The two-crew layout is the result of consultation with airline representatives and the arrangement of instruments, controls and screens conforms closely with the American S.A.E. recommendations. The Vanguard's technical and other features are described and illustrated in detail on pages 887-901 of this issue.

Photograph copyright "The Aeroplane"

than 80,000 lb.) was a good one. He asked which type of control column was preferred by pilots—favouring, himself, the type which came out of the dashboard—and whether 2-in. diameter engine instruments would be accepted. The problem of condensation, he agreed, was a serious one which had not yet been fully solved.

The main tenor of Capt. Kirkland's questions and comments concerned the need for a clear acceptance of priorities on the flight deck and for new thinking about the order of these priorities. A let-down chart, for instance, was more important in some circumstances than the engine instruments, and the undercarriage control and indicator were used only twice during each flight. The pilots' engine instruments might be designed to show clearly only the more critical changes in performance which affected immediate decisions; does the pilot, in short, need quantitative readings or simple "go/no-go" information? This thought led, later during the discussions, to the suggestion that dangerous changes in the reading of a jet-pipe temperature gauge might be fed into the take-off monitors of the future.

Mr. Davies found himself disappointed by BALPA's draft flight deck policy because it dealt with detail rather than with basic philosophies. He laid the blame for many of the current defects in layout detail on the airline operators; the manufacturer made aircraft to the customers' requirements and the airworthiness authority could do no more than ensure that the layout met requirements and was safe in use.

In the matter of crew complement he was firmly of the opinion that the third member should be a flight engineer, but agreed later that he could be a qualified pilot so long as he was also a qualified flight engineer and completed a full tour of duty in this position. He believed not only that aircraft of the same type used by a particular operator should have the same layouts, but that, so far as was practical, all aircraft types in an operator's fleet should be so standardized. All aircraft should be designed for the normal operational crew complement rather than for a minimum crew; a positioning or ferrying flight could involve conditions which were just as difficult as those met in normal service and if an aircraft were laid out so as to be practical with a minimum crew then the arrangements were likely to be unsuitable for use with a normal operational crew.

So far as broader issues are concerned, the onlooker came away from the meeting with two impressions. The first was that the trend in big aircraft was towards the use of a third pilot as a flight engineer, but that there were "career" and other difficulties if this pilot is to do a fully adequate job as an engineer while retaining his pilot experience and status. The second was that the next generation of aircraft (assuming that sizes continue to increase) might well be designed with simplified, rational displays and controls for the two pilots, so that they can concentrate on their essential piloting and navigational work, and with all non-essential and ancillary controls and purely quantitative instruments arranged elsewhere for the attention of a third crew member.—H.A.T.

An Aircraft Exchange Market

THE sale of new and second-hand transport aircraft will be facilitated by the formation of Aircraft Exchange, Inc., which will begin operations in New York on January 6, as we noted last week. The activities of Aircraft Exchange will be similar to those of other stock and commodity exchanges, its primary function being to keep a record of bids and offers for each aircraft type. Only aircraft of over 20,000 lb. gross weight will be handled at first.

The Aircraft Exchange will close the market at 15.00 hrs. (New York time) each Tuesday, and will then proceed to match highest bids and lowest offers for the purchase, sale or lease of aircraft, received from airlines, manufacturers, business aircraft owners, investors and Government agencies. By the end of Wednesday, interested parties will be notified that negotiations may be started, and a weekly market report will be issued on Thursdays.

According to the *Wall Street Journal*, membership of the exchange will be open to three categories. Regular members will be the airlines, aircraft manufacturers, owners and investors who may transact business in their own right, and will pay $30 a year. Associate members, for $20 a year, will be allowed to file bids or offers for non-members. Service members, who may not be directly concerned with selling or buying, will be able to obtain the weekly market report and will pay $10 a month. When a transaction is completed through the exchange, the seller will pay a concession on the gross value, ranging from 3% on $25,000 down to 1% on $6 million or more.

The exchange will operate on a limited profit basis, which will limit earnings (after payment of taxes) to 0.5% on the first $10 million of annual transactions, ranging down to 0.1% on all business over $50 million. Any profit above this limit will be paid back to regular members in proportion to their commission payments.

President of Aircraft Exchange, Inc., is Robert I. Helliesen, who was previously in charge of economic and market planning for American Airlines. First airline to become a regular member is Capital Airlines, and other companies reported to be in process of joining include American Airlines, Philippine Air Lines and Hawaiian Airlines.

Plans are now being made to set up a parallel market in London, which will operate along precisely the same lines as, but be independent of, the New York office. Mr. Charles Biondi, vice-president, was in London this week for discussions, and inquiries can be addressed to Aircraft Exchange, Inc., at 47 Princes Gate, London, S.W.7.

Co-operation in Practice

ONE of the first examples of co-operation between two airlines to improve the utilization of their jet fleets is provided by the Pan American-National link. With the provisional blessing, if not the active support, of the C.A.B. this link (discussed at length in THE AEROPLANE for September 26, 1958) became effective on December 10 with the introduction of a daily non-stop service by National between New York and Miami, using Pan Am. 707s. On December 16 the frequency of this service was increased to twice a day. National Airlines has thus become the first U.S. domestic airline to use turbojet equipment.

The present Pan Am. schedules for their six Boeing 707-120s actually involve a lower utilization than was originally planned because of the crew difficulties discussed in our issue for November 14 (p. 716). Assuming that the original plans had been possible, there would now be a daily service in each direction between New York and London, and between New York, Paris and Rome, requiring four aeroplanes to be in use all the time. The average daily utilization of these aeroplanes, on published schedules, works out at 8 hr. 50 min. each—or 5 hr. 55 min. each spread over the full fleet of six aeroplanes.

Scheduling on the New York-Miami route is 2 hr. 15 min. in each direction, which represents an additional nine hours' flying a day by two aeroplanes and brings the daily average over the fleet to 7 hr. 25 min. per aircraft.

FINAL ASSEMBLY.—Mounting production of the Douglas DC-8 is well illustrated in this picture, which shows the U-shaped final assembly line at Long Beach, California. At the end of this line (left background) can be seen the first Conway-powered DC-8 in T.C.A. markings.

A.T.C. Over the Atlantic

THERE is adequate air space for at least a tenfold increase in North Atlantic traffic without any particularly radical measures. Phrases such as "upper air saturation" and "the vanishing air space" give a misleading impression. The requirement is to use air space for control purposes much more economically by learning to operate not individual aircraft, but the mass movement of air transport, more economically.

This is the view of Mr. E. W. Pike, B.O.A.C. deputy flight services manager, as expressed in a paper on "Air Traffic Control over the North Atlantic," which he was to give before the Royal Aeronautical Society in London last night. He listed seven ways in which immediate remedial action appeared to be possible, if the economic consequences of operational difficulties were as serious as some thought they would be. These points were:

(a) Acceptance of a system of selected and co-ordinated tracks.
(b) Improved pre-flight co-ordination of flight plans to avoid unnecessary confliction.
(c) Use of a common meteorological forecast chart.
(d) Provision and general use of better radio navigation aids, such as Dectra, to provide accurate track keeping and flight progress data.
(e) Highly reliable and rapid air/ground and point-to-point communications.
(f) Use of a separation monitor as part of the ground-controlled A.T.C. system.
(g) Improved information handling and display techniques in A.T.C. centres, with a gradual move towards automatic computation to handle both static and dynamic flight information.

Mr. Pike began his paper by clarifying the responsibilities of air traffic control, and noting the existing methods of control over the North Atlantic—in which all civil flights are IFR, with separations of 1,000 ft. vertically (2,000 ft. above 29,000 ft.), 30 minutes longitudinally and 120 n.m. laterally, maintained by the various A.T.C. centres in the area. He showed how North Atlantic civil traffic has grown since 1948 to a record 25,492 civil flights in 1957, and a further 27% increase in the first half of 1958. Civil flights in 1957 represented slightly more than half of all the traffic over the North Atlantic.

The limitations of the existing system have been disguised to some extent by the fact that all civil aircraft have been piston-engined, able to accept large changes of altitude without serious effect on economy. Procedural changes and improved communications between Gander and Prestwick have helped matters but, even so, out of 242 DC-7C flights operated by B.O.A.C. in September, 1958, 70 (28.7%) had to accept some variation to flight plan for A.T.C. reasons.

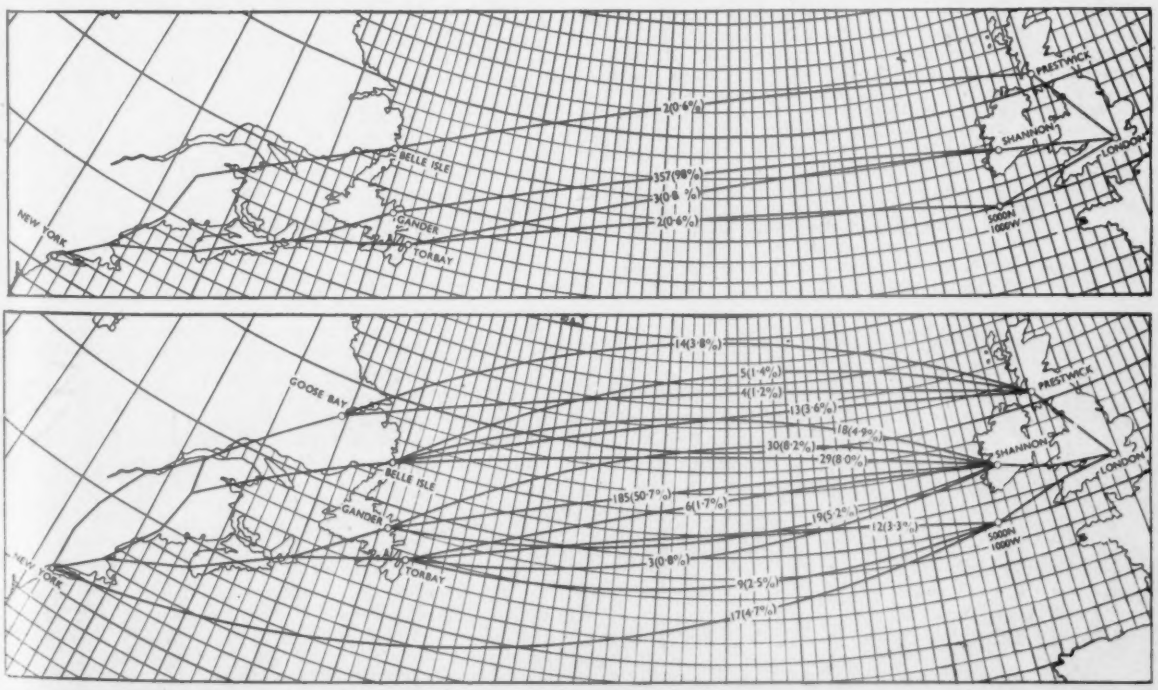
The longer range of newer piston-engined aircraft also helps, as there is now less concern from a safety standpoint about altitude restrictions. It was not uncommon at one time for an aircraft having planned a direct flight from New York to London to find itself in the early stages denied the optimum altitude through conflicting traffic, forced to dump a considerable quantity of fuel (because of landing-weight limitation) in order to land at Gander, and then take on even more fuel there before completing the flight.

The various procedural changes which have been introduced over the past few years were then closely examined by the author.

The first step was the decision that a flight-plan route, when filed, must be followed as closely as possible unless A.T.C. authorized a departure. It then became obvious that position reports must be co-ordinated, and it was agreed that these should be made at fixed lines of longitude at 10° intervals (and at intervening 5° intervals at the controllers' request).

This brought only limited relief because the distance represented by 30 minutes' flying time is too restrictive when combined with the pilots' preference for comparatively few altitudes and the airlines' natural desire to arrange their schedules at popular times. The next step, therefore, was to make better use of lateral separation, and to this end a meeting was held in the spring of 1958 to consider using a fixed-track system. For reasons which the author described as "incomprehensible in that they seem to ignore realities" many major operators refused to accept this, even on a trial basis; but the alternative (which is really a fixed-track system in disguise) of crossing the 10° longitude lines only at whole degrees of latitude was accepted.

Another improvement worked out between Prestwick and Gander centres themselves is the clearance of flights in either direction at flight levels normally available only to flights in the opposite direction. This can be done after receipt of flight plans and inspection of the meteorological situation, and is made possible by use of a direct telephone line between



These illustrations show all the tracks chosen in each direction in the course of a year's "paper" operation of the Boeing 707-420 by B.O.A.C. It will be seen that, eastbound (top), 98% of all flights were accommodated on one track; westbound, 50.7% were on one track, and 77% on five tracks.

Prestwick and Gander (at an annual cost of £35,000 for 10 hours daily).

Concluding his remarks on the current situation, the author drew attention to the responsibilities and loading on a North Atlantic air traffic controller, who may be concerned with the safety of 40 aircraft at a time, and remarked on the "almost fanatical insistence by some operators that they be allowed to plan flights in a completely unco-ordinated fashion, and to regard the difficulties facing the A.T.C. authorities as not their immediate concern."

Mr. Pike next went on to consider the special requirements of jet aircraft. Fuel requirements and reserves must be very carefully planned, and any likely A.T.C. restrictions must be considered during planning as they may reduce payload or require an additional refuelling stop. The penalties involved were illustrated by reference to the Boeing 707, where range is reduced by 5% at 4,000 ft. above optimum altitude and 4% at 4,000 ft. below. Operating in 4,000-ft. steps instead of cruise-climb involves a 1,300-lb. (or six-passenger) penalty in a critical operation. The cost of 5 minutes' additional flying in a large jet transport, although high, is only about one-fourteenth of the economic penalty suffered if it is necessary to reduce payload by the corresponding weight of extra fuel consumed.

Operational freedom in the vertical plane is then essential for jet aircraft. A further problem is the conflict with current aircraft, since turbojets will share some altitudes with turbo-props and must climb and descend through the lower flight levels. For instance, "how will a DC-8 westbound from Shannon be cleared through the altitudes of piston aircraft already beyond ground radar range?"

The present large-scale practice of granting clearances for changes in flight altitude "subject to maintaining VMC" (thus transferring the full responsibility for collision avoidance to the pilot) is quite unrealistic for jet aircraft. As one pilot has said, "if already on a collision course, looking out of the cockpit would mean you would die all tensed up."

To find a solution to the problems of A.T.C., both present and future, Mr. Pike suggested something could be learnt from the older transportation services. In every other case it seems that whenever congestion is reached in any transportation system, there must be technological advances in traffic handling, as well as acceptance as necessary by users of an appropriate measure of discipline.

Aircraft design advances have now outstripped both development and implementation of the services needed to match striking improvements in aircraft performance. The cost of services such as A.T.C., even if borne by governments rather than operators, can hardly be ignored when assessing the real economics of air transportation developments.

Possibly the dynamic growth of this industry in recent years is partly responsible for some of its difficulties. Many airlines are so heavily involved in dealing with immediate industrial, commercial and technical problems that there seems to be little spare effort for planning very far into the future. Governments committed by international agreement to providing ground services are acutely conscious of growing demands on their finances and, particularly where they consider these may be disproportionate, progress in reaching agreements and implementation is inevitably too slow.

In the case of the North Atlantic costs associated with ground services often are incurred because of geography rather than equity, and one cannot help feeling some more reasonable distribution of the economic burden is overdue. Although it would involve necessity for defence co-ordination with countries whose territory adjoins the North Atlantic, it would seem eminently logical for ICAO to establish an International Authority for operating all ground services required for air transportation over this ocean.

Such international authority would also help in the provision of a single synoptic weather chart. One of the present problems of traffic controllers is variations in flight planning, because of differences in the synoptic picture produced by different meteorological offices. Conflicting routeings and variation in elapsed time forecasts sometimes are based on differing wind forecasts and not on speed differences.

Communications and navigation aids cannot be held completely responsible for A.T.C. deficiencies on the North Atlantic. The first objective should be a proper route structure and associated A.T.C. procedures to move the required volume of traffic in complete safety from air-to-air collision hazard and in a smooth, orderly fashion without discrimination. Across the land masses on either side of the North Atlantic air traffic moves along airways fixed in number and size.

There is, the author thought, no really sound reason why a number of carefully chosen fixed routes across the ocean should not be introduced in the near future. Navigation aids, such as Dectra, can provide accurate track guidance over the whole crossing, making the existing lateral separation standards look grossly exaggerated.

Given a fixed-track system, the use of an airborne separation monitor (possibly secondary radar) would enable the distance between adjacent aircraft on the same track to be measured accurately in the cockpit. Jet aircraft could then be dispatched along the route preferred at a particular time with spacings of probably as little as 20 miles. Procedures for passing traffic in the same direction could easily be devised, subject to A.T.C. approval and, of course, opposite-direction traffic would invariably be cleared on a separate non-conflicting track.

Winds will have less influence on turbojets (because of their shorter flight times) and are, therefore, a less valid objection to fixed tracks than hitherto.

B.O.A.C. has just completed a year's "paper" operations of the Boeing 707-420 between London and New York. This exercise involved preparing a daily flight plan in each direction, based on upper-air charts supplied by the Meteorological Office, feeding into recognized entry points on either side of the Atlantic. All the tracks chosen in each direction are shown in the charts (reproduced on the previous page), together with the percentage of occasions on which they were selected. The general pattern is very similar to that of other Atlantic "paper" exercises the Corporation has conducted with, as one would expect, absence of the more extreme northerly and southerly routes sometimes chosen for aircraft of lower air speeds.

Once an adequate route structure, accurate and reliable navigation devices and satisfactory communications are all established, there remain problems of data handling and situation display at the control centre. Computing equipment can be introduced to perform routine calculations, but the trained controller will always be needed to deal with the unpredictable variables. The precise future rôles of the computer and the controller cannot safely yet be predicted, but for many years A.T.C. problems will call for a scientifically devised sharing of duties between machines and men, with final responsibility resting, as at present, firmly with the human controller.

The Silver City Cuts

AS we briefly recorded in last week's issue (p. 843), Silver City are reducing many of their vehicle fares next year, with emphasis on attractive rates for owners of small and medium-sized cars. This is the ninth occasion in 10 years on which reductions have been made, and the decision follows a 1958 reduced-rate season during which about 60% more cars were flown than in 1957.

On the Lydd-Le Touquet run, for instance, the cheap winter rates will continue until June 1 and thereafter small and medium-sized car rates will be up to 27½% less than the fares at last summer's standard rates. As a guide to the meaning of this reduction, a Morris Minor will be flown one-way for £5 by comparison with a fare of £6 10s. last summer. Peak fares, applied on 20 busy week-end days in July, August and September, will be cut by amounts up to 21½%. Power-assisted two-wheelers will be flown for 2s. 6d. instead of £1.

On the Lydd-Ostend and Southampton-Cherbourg services the fare cuts will be up to 37½% for small and medium cars. There will be minor increases on many services for some larger cars. Vehicle rates on the Southampton-Deauville service and all passenger fares remain unchanged.

Five vehicle-ferry-passenger services will be operated to and from France and Belgium during 1959. Three of these, between Lydd and Le Touquet, Calais and Ostend, will be operated throughout the year, and two, between Southampton and Cherbourg and Deauville, will be seasonal—March-October in the first case and June-September in the second.

During the Press conference at which the new rates were announced Mr. Eoin C. Mekie, chairman of Silver City, explained, among other things, that the vehicle-ferry operations, though successful, were far from being a "gold mine." During only four months of the year were revenues higher than costs—the ratio rose to 215%, for instance, in August, but was down to about 25% in the worst months. He hoped that freight would steadily increase to fill the gap in the winter months and to make still higher utilizations possible in the summer. The need for using a second airport in the U.K., possibly Manston, was also mentioned.

VANGUARD—FIRST SURVEY . . . .

Vickers' Second Generation Turboprop

OF the several noteworthy characteristics of the Vickers Vanguard, perhaps the most significant is that it is the first example of a "second-generation" turboprop transport. That is to say, at a time when most of the World's commercial aircraft manufacturers are busy developing and getting into operation their first turboprop and turbojet designs, Vickers are now entering the flight-test stage with their second original transport designed around turbine engines. The fact that the Vanguard has had built into it Vickers' wealth of experience derived from the development, manufacture and sale of 400 Viscounts should ensure that, engineering-wise at least, it is as good as a new aeroplane can be. It is not unreasonable to suppose that the introduction of the Vanguard into service will, therefore, be free of most of those snags and problems which have attended the first-generation turbine transports to date.

In subsequent pages the Vanguard's structure, systems and powerplants are discussed to show how Vickers engineers were influenced by their experience with the Viscount as well as by the more specific demands of the Vanguard specification itself. It is worth recording also, at this time, some of the events which led to the development of the Vanguard in the first place and which have influenced its subsequent evolution.

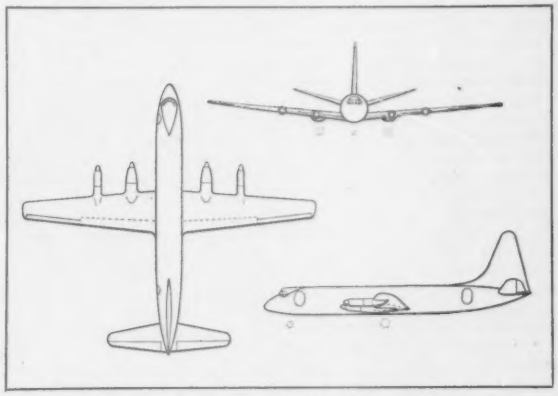
While the Viscount was evolving into a whole family of transports of varying size and performance, B.E.A. began to give more serious thought to the aeroplane which would follow the Viscount. As early as December, 1951, in fact, it was decided at a meeting of the B.E.A. Development and Programme Committee that studies should proceed with a view to developing a Discovery Replacement.

Although this decision did not immediately lead to work on a new turboprop in the Vickers project office, the Discovery Replacement did, in the end, turn out to be the Vanguard. So this is the proper point at which to start the development story.

In the early months of 1952, discussions within B.E.A. and between B.E.A. and Vickers were concerned with an aeroplane to carry 120 passengers over the existing B.E.A. route network in 1962 at cruising speeds of around 450 m.p.h. The specified capacity fitted in with forecast World traffic growth, but there was some hesitancy within B.E.A. about the need for an aeroplane of this size. There was agreement, however, between B.E.A. and Vickers, in March, 1952, that the project should be a pure-jet aeroplane. At this time Vickers were developing the V.1000 military transport and had every hope of selling the V.C.7 civil variant to B.O.A.C. For a time, therefore, discussions centred upon the V.C.7, or a smaller and lighter version powered by four Avons. Further studies in April, 1954, showed that a civil Valiant, with 120 seats, could be available for service in 1958, and might fit the requirement.

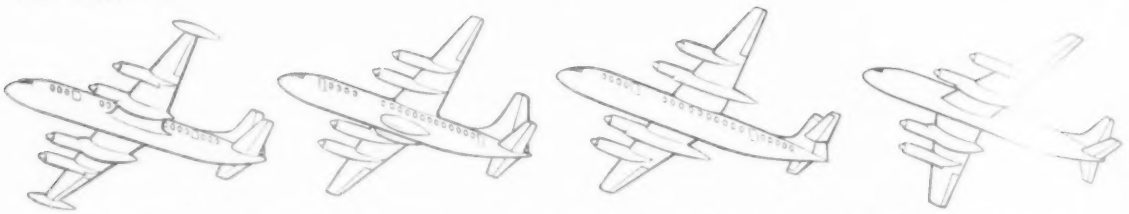
For much of the remainder of 1952 discussions went on within B.E.A. to assess the optimum passenger capacity for the Discovery Replacement, assuming it would be in service in 1958. One study was a comparison of the V.C.7 over stages of 200 to 1,200 nautical miles; over the shortest stage it could carry 155 passengers at a block speed of 235 m.p.h. and, over the longest, 87 passengers at 464 m.p.h. The optimum specific cost was 1.75 pence per seat-mile, over 600 n.m. with 144 seats. The commercial section, especially, of B.E.A. had its doubts about such a big jet aeroplane, and it is interesting to find that at this time much discussion centred upon the integration of this aeroplane with the 40-50-passenger helicopter which B.E.A. had specified and, it seems, thought might be in service by 1960.

By the end of 1952, B.E.A.'s future fleet plans included provision for "eight Victory aeroplanes, starting in service in 1958 with the full fleet by 1960." The type of aeroplane at this stage was far from certain, however, and the turboprop was beginning to come back into the picture.



The Viscount 870 as it was drawn in July, 1953, with four 4,000-h.p. Rolls-Royce turboprops. This was one of the earliest designs in the series leading to the Vanguard.

As a result of a careful re-assessment of the requirements, the latest B.E.A. view was outlined to Vickers on April 15, 1953, in a letter from Peter Masefield (then chief executive of B.E.A.) to George (now Sir George) Edwards. For service "not later than 1959," the Corporation wanted an aeroplane with better economics than any then available or on the stocks; faster than any competitor over all its stages; and with superior commercial characteristics to those of its likely contemporaries from the U.S.A. Specifically, it was to have a cruising speed of 370 knots, operate from runways 5,400 ft. long, and carry its design payload over a 1,000-st.-mile (London-Rome) stage with a 350-mile reserve. Accommodation was wanted for 100



Some of 60 design studies made in the Vickers 870 series before the Vanguard layout was settled. Second from the left is a layout much favoured by B.E.A., with wheels in fuselage-side fairings. The swept-wing studies were quickly abandoned.

seats four-abreast at 40-in. pitch or 125 five-abreast at the same pitch. A high-wing layout was preferred.

It should be said here that, whilst Vickers were thus in the happy position of having to look no further than their first Viscount customer to find a sponsor for the proposed new aeroplane, they knew, also, that the aeroplane must not be tailored *too* closely to the needs of a single airline if it were to have sufficient World-wide appeal to justify its production. Experience with the Viscount was thus already making its mark; design work to suit the Viscount to T.C.A. requirements took more man-hours than did the completion of the original design from scratch. And, as it happened, it was T.C.A.'s requirement for a "transcontinental Viscount-type aeroplane" that led Vickers to temper B.E.A.'s specification with some ideas of their own. By coincidence, T.C.A. submitted brief requirements of a 60-passenger 72,000-lb. aeroplane for transcontinental operation on April 15, 1953, also the date of Peter Masefield's letter to Sir George Edwards.

When this letter was written, B.E.A. had already seen the Vickers proposals for a Viscount 850. This existed in numerous versions, all of which were based on a lengthened Viscount fuselage (at about 95 ft.) and 2,500-h.p. Dart R.Da.8 engines. It was immediately clear that the V.850 could not be further considered in meeting the B.E.A. requirement—although it remained current in the Vickers project office for several more months. Attention then focused on the V.870—a type number which covered a whole series of proposals between 1953 and 1955, leading finally to the V.950 Vanguard of today.

On May 14, 1953, at a meeting between Vickers and Rolls-Royce, the decision was taken to use a new Rolls-Royce turboprop—the R.B.109—in the V.870 aeroplane. This agreed both with B.E.A. and T.C.A. views at that time and Vickers' own preference for turboprops for an aeroplane of this category. Studies had shown that an aeroplane of the kind wanted by B.E.A. would have an operating cost of 11.35d. per ton-mile as a turboprop against 12.4d. for a turbojet. A study in November, 1953, of a V.870 for T.C.A. with "baby Conways" of 6,500-lb. thrust was equally unfavourable. It showed that, for a transcontinental operation with 17,500-lb. payload, the jet was 7,000 lb. heavier, 7-8% more expensive, 12 knots faster and 2% faster on the approach. For a transatlantic operation, taking off from Shannon at 105,000 lb., it could carry 8,000 lb. of payload compared with 13,500 lb. by a turboprop at the same weight.

"Optimizing" the Design

From the middle of 1953 on, therefore, the Vickers project office was concerned with the "optimization" of the V.870 design. The turbojet had been rejected; so, too, after a brief investigation, was the swept-back wing, which was of little advantage for 460-m.p.h. cruising speeds and adversely affected the approach speed. Still unresolved, however, was the question of wing location—high or low.

B.E.A. had favoured the high-wing arrangement in their original specification, largely because of the favourable passenger reaction which followed the introduction into service of the Elizabethan in March, 1952. Although there was no particular difficulty in meeting the initial requirements with a high-wing aeroplane, Vickers were less convinced of its attractions in the World market. T.C.A., whose interest in the V.870 has already been noted, listed nine reasons why they preferred a low wing.

In addition to the intangible advantages deriving from such things as the use of a known configuration and the location of the jet exhaust where it cannot be seen from the cabin, T.C.A. listed among low-wing advantages easier refuelling and servicing and the importance of being able to see the top of the wing from the cabin during the take-off run in heavy snow.

These opinions weighed heavily with Vickers, but high- and low-wing projects were continued in parallel and there was little to choose between the two. In January, 1954, for instance, a V.870 brochure submitted to B.E.A. showed a 97,000-lb., 80-passenger aeroplane in high- and low-wing versions. The high-wing variant suffered a 1,300-lb. structure weight penalty, but carried a little more fuel and could fly a little farther with the same payload.

Throughout 1954 the project office at Weybridge continued these studies, while B.E.A. kept their requirements under constant review. One factor which now became increasingly important, and was eventually to have a very considerable influence on the shape of the Vanguard, was B.E.A.'s need for good freight-carrying ability. With their particular daily and seasonal peak-and-trough traffic problems, B.E.A. needed to be able to carry a very high proportion of the total payload as freight, even on normal scheduled passenger services.

Freight Provisions

The provision of adequate freight holds on the same floor as a passenger cabin seating up to 100 passengers could lead only to an unacceptable fuselage length, or a fuselage diameter sufficient for six-abreast seating in the basic version. The obvious alternative was underfloor freight holds; and when B.E.A. specified a working height of between 4 ft. and 4 ft. 6 in. in these holds the "double-bubble" cross-section became the only possible solution, as well as an attractive one structurally. With a double-bubble, a low-mid-wing position followed naturally. The size and shape of the fuselage was also influenced by B.E.A.'s requirement that it should be wide enough only for five-abreast seating at normal tourist standards.

Many of the projects, both high- and low-wing, were to use "plain flaps with boundary-layer control"—that is to say, blown flaps. The demands upon engine compressor air finally proved unacceptable, however, so Fowler-type flaps were adopted instead. An early decision had been made in favour of integral construction and the use of integral fuel tanks was specified by T.C.A. and favoured by Vickers.

By early 1955, therefore, most of the major design decisions had been made, other than the wing position. The aeroplane was now seen with a weight of around 95,000-100,000 lb., having a payload of 17,500 lb., a span of about 115 ft. and a length of about 100 ft. The Rolls-Royce R.B.109, originally regarded as a 2,750-e.h.p. engine, was now required to give at least 4,500 e.h.p. at the start and Rolls-Royce were talking about take-off powers up to 5,000 e.h.p. in January, 1955.

Discounting earlier V.850 studies and the turbojet investigations, Vickers had prepared 60 design studies for the V.870 by the spring of 1955. Of these, five were selected as the most suitable for further development, and were finally considered by a B.E.A. team at Weybridge on April 13 of that year. At this meeting, B.E.A. was represented by Peter Masefield, B. S. Shenstone (chief engineer), R. C. Morgan (chief project and development engineer), and Mr. P. W. Brooks (technical assistant to the chief executive). Sir George Edwards was supported by Basil Stephenson (then chief designer), G. F. H. Hemsley (then assistant chief designer), E. E. Marshall (then chief project engineer), and Arnold Wright (project aerodynamicist).

Agreement was reached at this meeting that the double-bubble aeroplane with a low-mid-wing was the most promising—and in Vickers' view the most likely to find a World market. The specification of this aeroplane, in April, 1955, included: gross weight, 110,300 lb.; capacity payload, 26,000 lb.; design payload, 20,000 lb.; span, 114 ft.; length, 112 ft.; wing area, 1,400 sq. ft.; fuselage cross-section, 155 in. by 134 in.; accommodation, 88 passengers five-abreast at 39-in. pitch; fuel, 4,250 Imp. gallons; speed, 420 m.p.h. at 25,000 ft.

This was the aeroplane—the V.870 Scheme 1na—which was passed from the project office to the design office and which, after some further detail revisions to meet the final B.E.A. Specification of Requirements, was ordered by B.E.A. in 1956. In one important respect, however, this was no longer the aeroplane which B.E.A. wanted. Whereas B.E.A. had originally talked about a design range of 1,000 st. miles and by 1955 were primarily interested in a range of only 500 miles—the kind of stage-length which was proving the real money-maker—Vickers had been steadily stretching the range to please T.C.A. and other operators, so that, on the integral wing tankage (finally settled at 5,100 Imp. gal.) alone the range with original design payload grew to 2,600 st. miles.

As soon as the basic configuration of the B.E.A. aeroplane was decided and detail design work began, under the direction of D. Parker, assistant chief designer, the type became identified as the Vickers V.900 Vanguard, the B.E.A. variant being the

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V.901. As finally agreed by B.E.A., the payload was 21,000 lb. and basic accommodation was for 93 passengers. Over the stages B.E.A. specified this aeroplane could operate with full payload at a take-off weight of 115,000 lb., but the size of the aeroplane—and its gross weight—were now controlled by the max.-payload range which Vickers believed essential to meet World requirements. A gross weight of 135,000 lb. was therefore obtained, B.E.A. accepting a small weight penalty involved in modifying the undercarriage and wing structure. This basic type now became the V.950, and V.951 for B.E.A.

The first B.E.A. announcement regarding the Vanguard, on October 17, 1955, spoke of "negotiations for a fleet of these aircraft to be in service in 1960"; a contract for 20 was completed on July 20, 1956. From the outset Vickers had made it clear that they would undertake the Vanguard as a private venture; consequently, the Ministry of Supply was at no time involved in these negotiations and the contract was the first of substantial size placed with the British aircraft industry directly by one of the two State Corporations. The first Vanguard off the line is, in fact, Vickers-financed.

The T.C.A. Decision

Once it was certain that B.E.A. would order the Vanguard, T.C.A.'s interest in the project grew rapidly. To suit T.C.A. the V.950 had a major drawback in the fact that, with a full passenger payload and full tanks, the freight load was reduced almost to zero. On certain routes T.C.A. are required by the Government to give priority mail preference over passengers. They therefore had to be able to carry a greater payload in the V.950 whilst retaining the maximum-range performance already offered, and development in this direction also opened up the possibility of carrying 120 passengers, six-abreast in couch-class layouts. Vickers submitted a Vanguard variant, the V.952, in which the payload went up to 24,000 lb., with consequent increases in landing and zero-fuel weights. The airframe was strengthened for higher cruising speeds at low altitudes, and the gross weight rose to 141,000 lb.

After a thorough investigation, in which the Electra with Tynes was a strong favourite, T.C.A. concluded that the Vanguard was now the best aeroplane for their longer domestic routes. In May, 1956, a contract was about to be concluded when Douglas proposed their Avon-powered DC-9, and T.C.A.—with DC-8s on order and a high regard for Douglas commercial ability—reopened the investigation. It was this development which led Vickers to offer the so-called Vanjet to T.C.A. The Vanjet was, in fact, a whole series of project studies which broadly could be considered as Vanguard fuselages with two, three or four turbojets in various positions. [These studies were being pursued in answer to the B.E.A. requirement for a short-haul jet and, after a compromise attempt to meet in one design both B.E.A. and B.O.A.C. requirements, led eventually to the V.C.10 for B.O.A.C.]

By November, 1956, T.C.A. had once again concluded, after one of the most exhaustive competitive evaluations ever undertaken, that the Vanguard was right; and early in January, 1957, an order for 20 was announced.

For best performance at the new weight the Vanguard requires the developed form of the Rolls-Royce Tyne known as the Stage II or R.Ty.11. This version, at first rated at 4,830 s.h.p., is currently offered at 5,030 s.h.p., compared with the 4,500 s.h.p. of the R.Ty.1. The T.C.A. fleet will use R.Ty.11s, but B.E.A.'s aeroplanes, at the lower gross weight, are expected to use the R.Ty.1 Mk. 506.

Also relevant to the Vanguard's performance is the propeller fitted; a high-activity-factor (160) propeller is necessary and gives a small but significant improvement in permissible take-off weight from poor airfields and at extreme elevations. Where airfield lengths are not limiting, the 138-activity-factor D.H. propellers, developed initially for the Vanguard, are adequate.

In the course of 1957, discussions between Vickers and prospective customers showed that there might be a need for still more payload and it was found that this could be provided if the maximum range were not wanted. The possibility of introducing economy-class travel in Europe made this new proposal of particular interest to B.E.A., who found they could now seat up to 139 passengers in the Vanguard, six-abreast at 34-in. pitch, and still have the flexibility between freight and passenger loads originally offered.

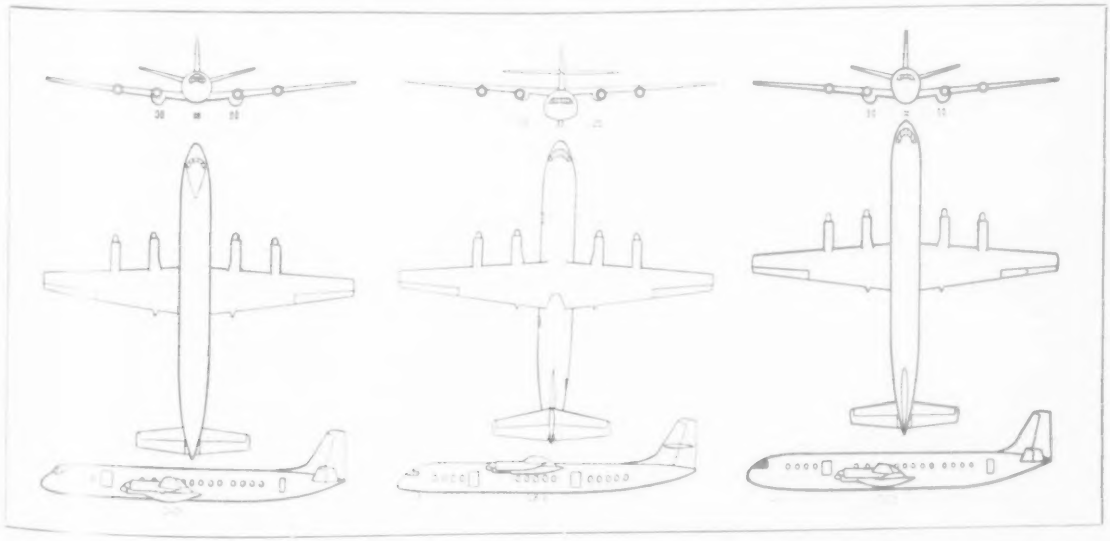
Vickers announced this Vanguard Mk. II on July 23, 1958, as the new basic type with a 29,000-lb. payload. Zero fuel and landing weights were once again increased as a result of structural alterations and strengthening. While fuel capacity remains unaltered, the range with maximum payload is reduced to 2,000 st. miles (with reserves).

To take advantage of the very low direct operating costs of the Vanguard Mk. II—ranging from 2d. a seat-mile at 250 miles to 1.35d. a seat-mile at 1,000 miles—B.E.A. have now decided to take 14 of their fleet in this guise, to be known as the V.953. The first six will be delivered as V.951s.

To summarize, then, the Vanguard is the result of continuous design evolution from the Viscount and has already been developed into three distinct stages, each of which is to be built. These are the Type 951 for B.E.A., at 135,000 lb. with 21,000-lb. payload; the Type 952 for T.C.A. at 141,000 lb. with 24,000-lb. payload; and the Type 953 for B.E.A. at 141,000 lb. with 29,000-lb. payload.

Various long-range applications have been studied, in which extra fuel can be carried in the belly, centre-section or tip-tanks; with up to 1,000 Imp. gal. more fuel, the Vanguard would be practicable as a non-stop aeroplane on the Atlantic. Weights up to 160,000 lb. can be envisaged. Studies have also been made of a Vanguard Freighter, which would have a gross weight of 150,000 lb. and a payload of 40,000 lb.

As soon as the first Vanguard is in the air Vickers will start on the 1,600-hr. test-flight schedule which is intended to end with a full British C. of A. by March, 1960. This programme involves the use of four of the B.E.A. aircraft in addition to Vicker's own Vanguard. Deliveries to B.E.A. and T.C.A. can then be expected to begin in the spring and autumn, respectively, of 1960, by which time production will be at the rate of three a month.—F.G.S.



Three of the five projects from which the final choice was made in April, 1955—from left to right, Vickers 870 Schemes 14, 15 and 16. Also considered was another high-wing version, with a circular section fuselage, and another low-mid-wing design similar to Scheme 16, which was finally chosen for development.

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Engineering the Vanguard

EXPERIENCE with the Viscount in airline service and the development of its airframe over the years has formed the basis of structure design for the Vanguard. This experience has been enlarged upon and developed to suit the new requirement in accordance with the current state of the art of airframe design.

Fuselage structure of the Vanguard is generally similar to that of the Viscount except that the underfloor freight holds of the Vanguard are in the lower part of a "double-bubble" section instead of being under the floor of a circular fuselage.

Most of the fuselage consists of 20-in.-pitch channel-section rolled frames with Z-section stringers at about 5-in. spacing flush-riveted to the skin panels. The frames and stringers are continuous, the frames being shear-cleated to the skin or notched for the stringers to pass through.

In a few places where the stringers are broken, such as at cut-outs or major machined frames, finger plates carry the loads across the breaks. In some cases, small forgings take loads from the stringers. Cut-outs are framed by machined members and Redux-bonded reinforcing plates are also riveted in place. Around a structural discontinuity half the load is taken by the skin and reinforcing and half in the main structural members.

Minimum fuselage skin-thickness is 19 s.w.g. light alloy giving a maximum hoop stress of 12,000 p.s.i. In the region of the wing roots the fuselage skin is of heavier gauge to assist load-diffusion. Generally, throughout the pressure cabin us of 70° countersunk-head rivets instead of dimpling.

This relatively low stress-level in the fuselage, with the fact that nowhere is there more than 100 unsupported skin, should ensure that any crack-pr would be slow enough to be seen on inspection. The load-path structure with its numerous crack-stopp truly "fail-safe" type and has been designed to ha fatigue life.

To take loads from the three vertical shear webs of torsion box the appropriate trio of fuselage frames ably substantial construction. These three spar fra side members built up from forgings which mate on the spar webs. The forgings are tapered off pa above the webs and stop half-way up the cabin wall are of each frame being a simple channel-section fra the other fuselage frames.

Compared with the Viscount, the Vanguard fuselage basic structural differences. Complete splices of ski in single planes instead of having the skin edges and staggered, which might raise local stresses because variation.

The second difference is that in the nose-wheel Vanguard fuselage is pressurized below floor nosewheel retracts into a non-pressurized box

(*Continued on page* 897)

Key to Cutaway Drawing

Fuselage

1. Front pressure-bulkhead.
2. Wide side-entry to pilots' seats.
3. Unpressurized nosewheel box.
4. Passengers' entrance, with power-folding airsteps.
5. Emergency and galley-service door (to starboard).
6. Galley and steward's seat.
7. Forward cargo hold and large loading-hatch near to ground with upper and lower half-doors, as (8).
9. Movable bulkhead, standard position (9), alternative positions (10).
11. Two washrooms each side, or with wardrobes.
12. Rear underfloor cargo hold with large loading hatch.
13. Wardrobes, passengers' entrance door and airsteps.
14. Galleys with emergency and galley-service door between.
15. Angled doors to two washrooms.
16. Rear pressure-bulkhead forms back wall to washrooms.
17. Emergency door and steward's seat.
18. Six-across seating (thrift-class layout).
19. Five-across (tourist layout).
20. Four-across (first-class layout).
21. Seats have rail and side fixing.
22. Typical structure (frames, proud stringers, stressed skin, with floor beams (23), side wall (24) to services-compartment all along, and stressed floor (25) to hold).
26. Built-in three-web centre-section with lugs as (27).
28. Inspection manholes.
29. Three-web fin and tailplanes, with fixings (29).

Wings

30. Butt-joints and straps (centre-section to inner-wing).
31. Solid-wall rib (end of fuel tankage).
32. Top-skin manholes.
33. Bracketing for engine pick-ups.
34. Four-plank skinning with integral stiffeners.
35. Butt and strap joint (inner to outer wing).
36. Solid-wall rib (barrier between inner and outer fuel tanks).
37. Plated inspection cut-outs in front and rear spars.
38. Aileron inspection panels all along, below and above.
39. End of inner-wing trailing-section.
40. End of outer-wing middle spar.
41. Three-plank skinning.
42. Fuel tankage right out to wing tip (42).
43. Fuel jettison pipe.

Flying Controls (Elevator, Rudder and Aileron)

44. From stick (44) with its parallel-motion strut (45) to elevator via hinge-point (46); links (47) and rods along services-compartment (as at 24), then under centreplane and aft to gland-box (48) and gaiter (49).
50. Floor cut-away to reveal gland-box mounted on fuselage skin free of pressure-bulkhead (16) to allow for difference in expansion of fuselage and controls.
51. Cut-out in (16) reveals controls rods (52) to tail from (48). The rods pass clear through (16) with (49) as a seal.
52A. Rudder and elevator auto-pilot servo motors.
52B. Geared (auto) tab.
52C. Spring (hand) tab.
53. Rudder pedals in fore-and-aft tracks, linkages, 54, 55, 56, thence along and under wing to (48) and (52).
57. From stick (44) and linkage (57) along fuselage and under centre-section to aileron rods (58) at rear spar, linkage 59 to spring-tab (60).
61. Hand-trim linkage.
62. Geared (auto) tabs.
63. Aileron servo (in centre-section).

Flying Controls (Flaps)

64. Flap guide-rail outrigger.
65. Flap guide-and-tilt rail outrigger (straight top rail carries pair of flaps, curved lower rail tilts flaps).
66. Hydraulically-operated screwjack behind starboard back-spar (rotates operating rod (67) to pull flaps in and out).

Undercarriage

68. Main pick-up of forwards-retracting main undercarriage.
69. Radius-rod pick up.
70. Operating jack.
71. Main pick-ups of forwards-retracting nosewheel leg (carries steering jack 72).
73. Radius-rod pick-up, door retraction and UP-latch beam.
74. Oleo-positioning track and wheel-spin brake.

Engine Installations

75. Tyne engine inlet casing.
76. Gearcase with power-take-off to auxiliaries' gearbox (77).
77. All four gearboxes carry on the front face a breather, propeller parking-brake pump, hydraulics system pumps, and alternator. Outer two gearboxes carry alternator on back face. The inner gearboxes carry blower on back.
78. Rubber mounting-blocks (in bearer feet on engine).
79. Combustion chambers and turbine section.
80. Engine fireproof bulkhead. (Engine exhaust unit protrudes into jet pipe exhaust cone attached to 81).
81. Second fireproof bulkhead carrying engine snubber ring and exhaust cone.
82. Jet pipe.
83. Oil cooler and airflow (84).

Engine Ventilation and Fire Protection

85. Zone I (from front, back to 80) air bled off 84, and in via 86. Out at 87.
85A. Zone IA.
88. Zone II (entry at 89).
90. Zone III (on inboard it is fed from cowling intake, but on outboard it is fed off heat-exchanger ram air).
91. Zone IIIA with inlet and outlet (92).
93. Two groups of two bottles in each wing. Each group serves its own nacelle and the other nacelle.
94. Spray rings in zones I and II.
95. Fire-detector wiring.

Cabin Air System (see also separate diagram)

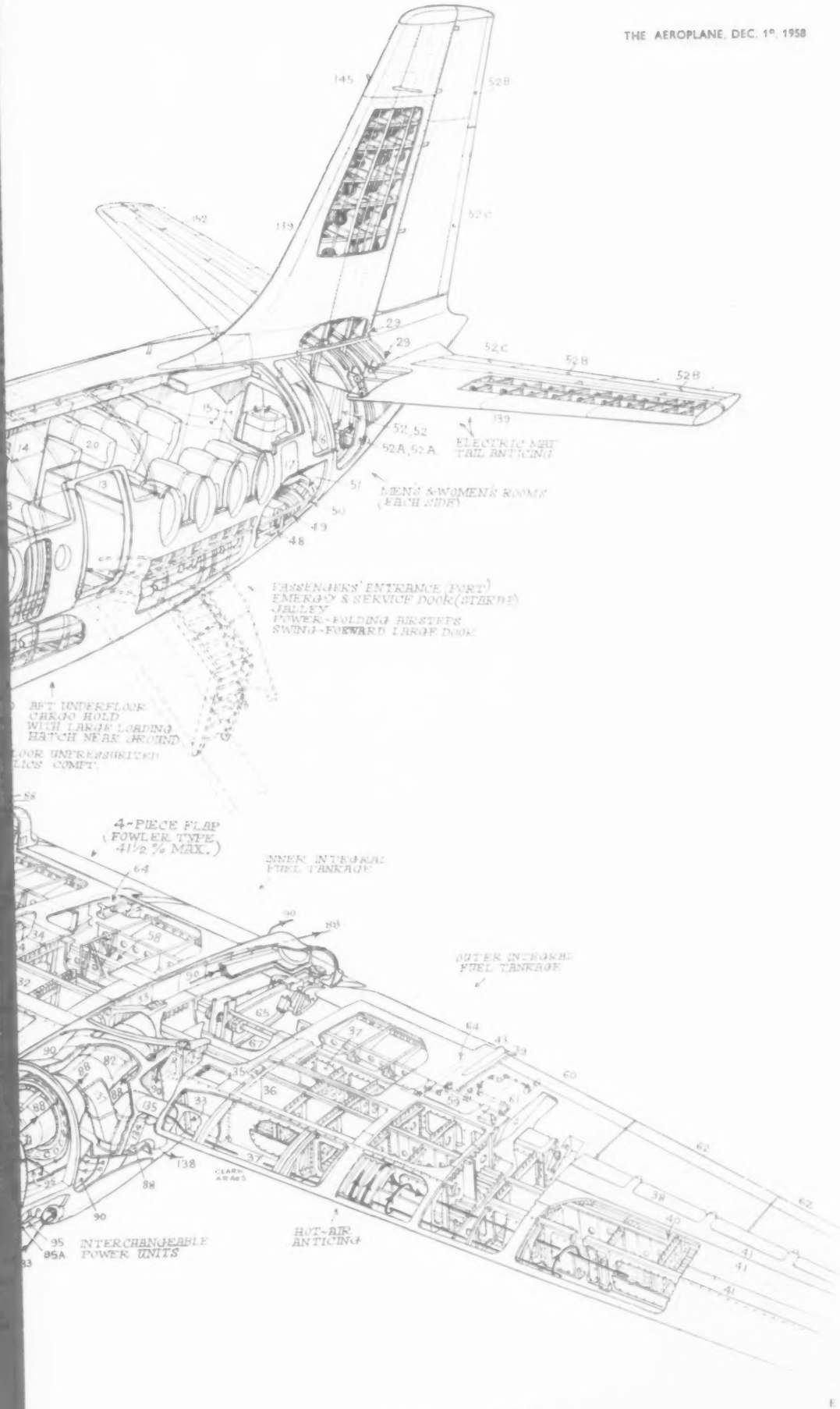
96. Filter intake to engine-driven blower (96A), out to silencer and fuselage at 97. (There is a spill vent with silencer, 98 and a feed-back 99 to give "second time round" through the blower for maximum heating.)
96B. Ground pressure test-connection.
100. Blower-air trunk and cross-feed from starboard wing, to primary cooler 101, cooled and out back to cold-air unit turbine 102, thence through secondary cooler [illegible] on through silencer [illegible] supply when [illegible] (100).
105A. Cold air boost fan.
107. Off trunk 100 take [illegible] control valve 108 [illegible] (roof) trunk 109.
110. By-pass (110 (roof) [illegible] feed (105) louvre [illegible]
111. Interconnector 111 [illegible] cated air to 109.
112. Warm air out into cabin.
113. Some warm air by-[illegible] out into cabin at [illegible] heat out through [illegible]
116. Cabin air collected [illegible] and down (as [illegible] (radiating heat from [illegible] on way). Thence [illegible] charge valves 119 [illegible]
119A. Inwards relief valve.
120. Some cabin air is [illegible] 121 from starboard [illegible] recirculating air, [illegible] 122 and recirculation [illegible] duct 109.
122A. Recirculation check [illegible]
124. Extraction from wing [illegible] wing) then overboard [illegible]
125. Flight deck hot air [illegible]
125A. Control valve, [illegible]
126. Pilots' cold air [illegible]
126A. Third crew member's [illegible]
127. Hot tapping off 100 [illegible] with cold flow off [illegible]
127A. Electric heaters [illegible] needed.
128. Primary-cooler air [illegible]
130. Secondary cooler [illegible] extractor fan 131 [illegible] air supply off 127.
132. Ground conditioning [illegible] from recirculating [illegible]

Ice-protection System

133. Ram air into heat-[illegible] edges at 135 and 136 [illegible] inboard nacelle.
137. Hot gases through [illegible] nacelles).
139. Electric-mat anti-ice [illegible]

Radio

140. Scanner.
141. Stand-by VHF aerial.
142. VHF aerial.
143. ADF loop aerials.
144. HF wire aerials (6).
145. ILS localizer VOR aerial.
146. Radio altimeter aerials.
147. ILS marker aerial.
148. RECCA aerial.
149. ADF sense aerial.
150. HF slot aerial [illegible] and starboard).
151. VHF aerial.
152. Static discharger [illegible]
153. Radio crate [illegible]
154. Glide-slope aerial.



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ring the Vanguard

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diffusion. Generally, throughout the pressure cabin use is made of 70° countersunk-head rivets instead of dimpling.

This relatively low stress-level in the fuselage, combined with the fact that nowhere is there more than 100 sq. in. of unsupported skin, should ensure that any crack-propagation would be slow enough to be seen on inspection. The multiple load-path structure with its numerous crack-stoppers is of truly "fail-safe" type and has been designed to have a long fatigue life.

To take loads from the three vertical shear webs of the wing torsion box the appropriate trio of fuselage frames is of suitably substantial construction. These three spar frames have side members built up from forgings which mate with lugs on the spar webs. The forgings are tapered off progressively above the webs and stop half-way up the cabin wall, the top arc of each frame being a simple channel-section pressing like the other fuselage frames.

Compared with the Viscount, the Vanguard fuselage has three basic structural differences. Complete splices of skinning are in single planes instead of having the skin edges and stringers staggered, which might raise local stresses because of stiffness variation.

The second difference is that in the nosewheel bay the Vanguard fuselage is pressurized below floor level and the nosewheel retracts into a non-pressurized box let into the shell

(*Continued on page* 897)

to Cutaway Drawing

1. Rudder pedals in fore-and-aft tracks, linkages, 54, 55, 56, thence along and under wing to (48) and (52).
2. From stick (44) and linkage (57) along fuselage and under centre-section to aileron rods (58) at rear spar, linkage 59 to spring-tab (60).
3. Hand-trim linkage.
4. Geared (auto) tabs.
5. Aileron servo (in centre-section).

Flying Controls (Flaps)

4. Flap guide-rail outrigger.
5. Flap guide-and-lift rail outrigger (straight top rail carries pair of flaps; curved lower rail tilts flaps).
6. Hydraulically-operated screwjack behind starboard back-spar (rotates operating rod (67) to pull flaps in and out).

Undercarriage

8. Main pick-up of forwards-retracting main undercarriage.
9. Radius-rod pick-up.
10. Operating jack.
11. Main pick-ups of forwards-retracting nosewheel leg (carries steering jack 72).
13. Radius-rod pick-up, door retraction and UP-latch beam.
14. Oleo-positioning track and wheel-spin brake.

Engine Installations

16. Tyne engine inlet casing.
17. Gearcase with power-take-off to auxiliaries' gearbox (77).
17. All four gearboxes carry on the front face a breather, propeller parking-brake pump, hydraulics system pumps, and alternator. Outer two gearboxes carry alternator on back face. The inner gearboxes carry blower on back.
18. Rubber mounting-blocks (in bearer feet on engine).
19. Combustion chambers and turbine section.
20. Engine fireproof bulkhead. (Engine exhaust unit protrudes into jet pipe exhaust cone attached to 81).
21. Second fireproof bulkhead carrying engine snubber ring and exhaust cone.
22. Jet pipe.
23. Oil cooler and airflow (84).

Engine Ventilation and Fire Protection

25. Zone I (from front, back to 80) air bled off 84, and in via 86, out at 87.
25A. Zone IA.
28. Zone II (entry at 89).
30. Zone III (on inboard it is fed from cowling intake, but on outboard it is fed off heat-exchanger ram air).
31. Zone IIIA with inlet and outlet (92).
33. Two groups of CO2 bottles in each wing. Each group serves its own nacelle and the other nacelle.
34. Spray rings in zones I and II.
35. Fire-detector wiring.

Cabin Air System (see also separate diagram)

36. Filter intake to engine-driven blower (96A), out to silencer and delivery at 97. (There is a spill vent with silencer (98) and a feed-back 99 to give "second time round" through the blower for maximum heating.)
37. Ground pressure test-connection.
39. Blower-air trunk and cross-feed from starboard wing, to primary cooler 101, cooled and out back to cold-air unit turbine 102, thence through secondary cooler 103, back to cold-air unit 104 on through silencer/water-separator 104 and crew supply when mixed with bleed 127 off (100).
105A. Cold-air boost fan.
107. Off trunk 100 take supply 107 via temperature control valve 108 to feed cabin main warm (roof) trunk 109.
110. By-pass 110 (roof) from primary cooler 101 feed (105) louvre supply and louvres (106).
111. Interconnector 111 from 105 to 109 give recirculated air to 109 automatically.
112. Warm air out into cabin.
113. Some warm air bled down to radiator 114 out into cabin at 115; radiators (all along) heat out through cabin walls 114A.
116. Cabin air collected at 116 and out through and down (as 118) into cargo underfloor (radiating heat from cargo compartments on way). Thence along and overboard via charge valves 119 under wing.
119A. Inwards relief valves.
120. Some cabin air is extracted as at 120 (with 121 from starboard side) and ducted (122) recirculating air, with unpressurized-flight 122 and recirculating fan 123, into 107 and duct 109.
122A. Recirculation check valve.
124. Extraction from washrooms cools inverter wing) then overboard via 119.
125. Flight deck hot air (off 104).
125A. Control valve, roof warm air.
126. Pilots' cold air (off 105).
126A. Third crew member's cold air supply.
127. Hot tapping off 100 to flight-deck flow with cold flow off 105).
127A. Electric heaters in ducts step up heating needed.
128. Primary-cooler air in (out at 129).
130. Secondary cooler air out (along with 129 extractor fan 131 in a cross-connection duct air supply off 127.
132. Ground conditioning supply into 105 with from recirculating duct 121 back into 107

Ice-protection System

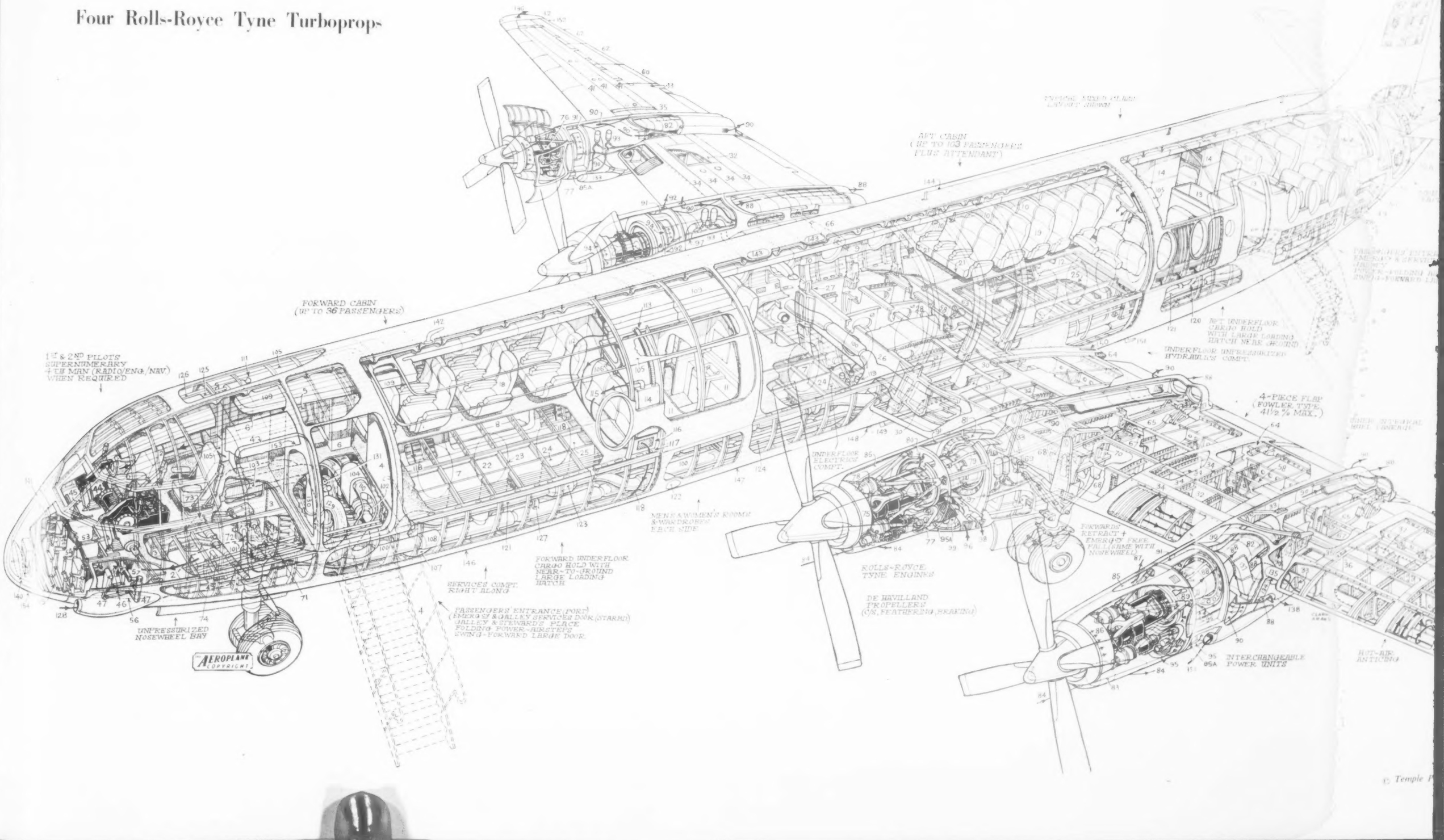
133. Ram air into heat-exchanger 134, out into edges at 135 and to wing tip spill 136 plus inboard nacelle.
137. Hot gases through 138 and out at 139 (nacelles).
139. Electric-mat anticing to fin and tailplane.

Radio

140. Scanner.
141. Stand-by VHF aerial.
142. VHF aerial.
143. ADF loop aerials.
144. HF wire aerials (port and starboard).
145. ILS localizer VOR aerial.
146. Radio altimeter aerials (under).
147. ILS marker aerial (under).
148. DECCA aerial.
149. ADF sense aerial (each side).
150. HF slot aerial (see wing-root trailing edge and starboard).
151. VHF aerial.
152. Static discharge wicks.
153. Radio crate (cockpit).
154. Glide-slope aerial.

THE VICKERS VANGUARD

Four Rolls-Royce Tyne Turboprops



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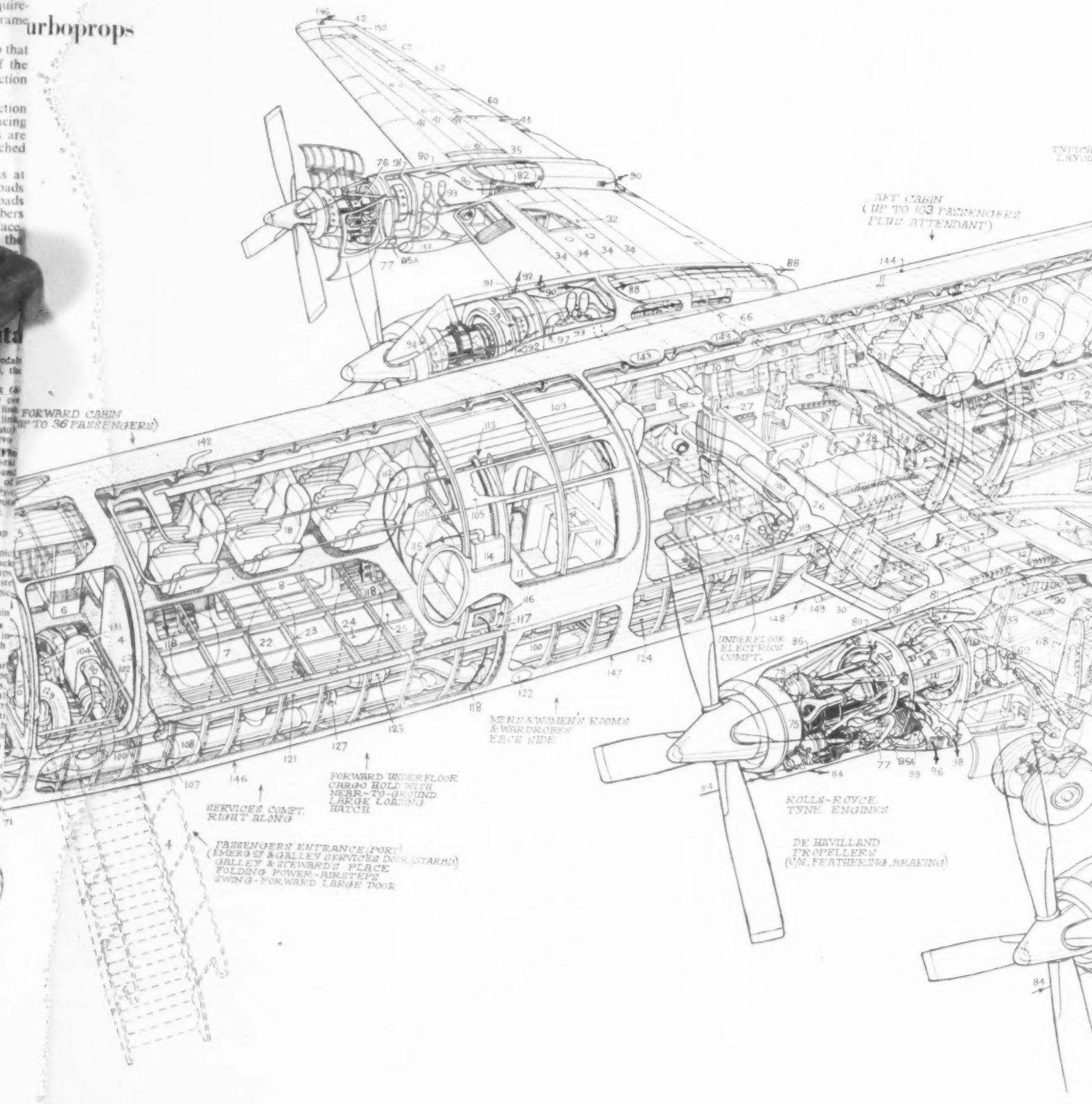
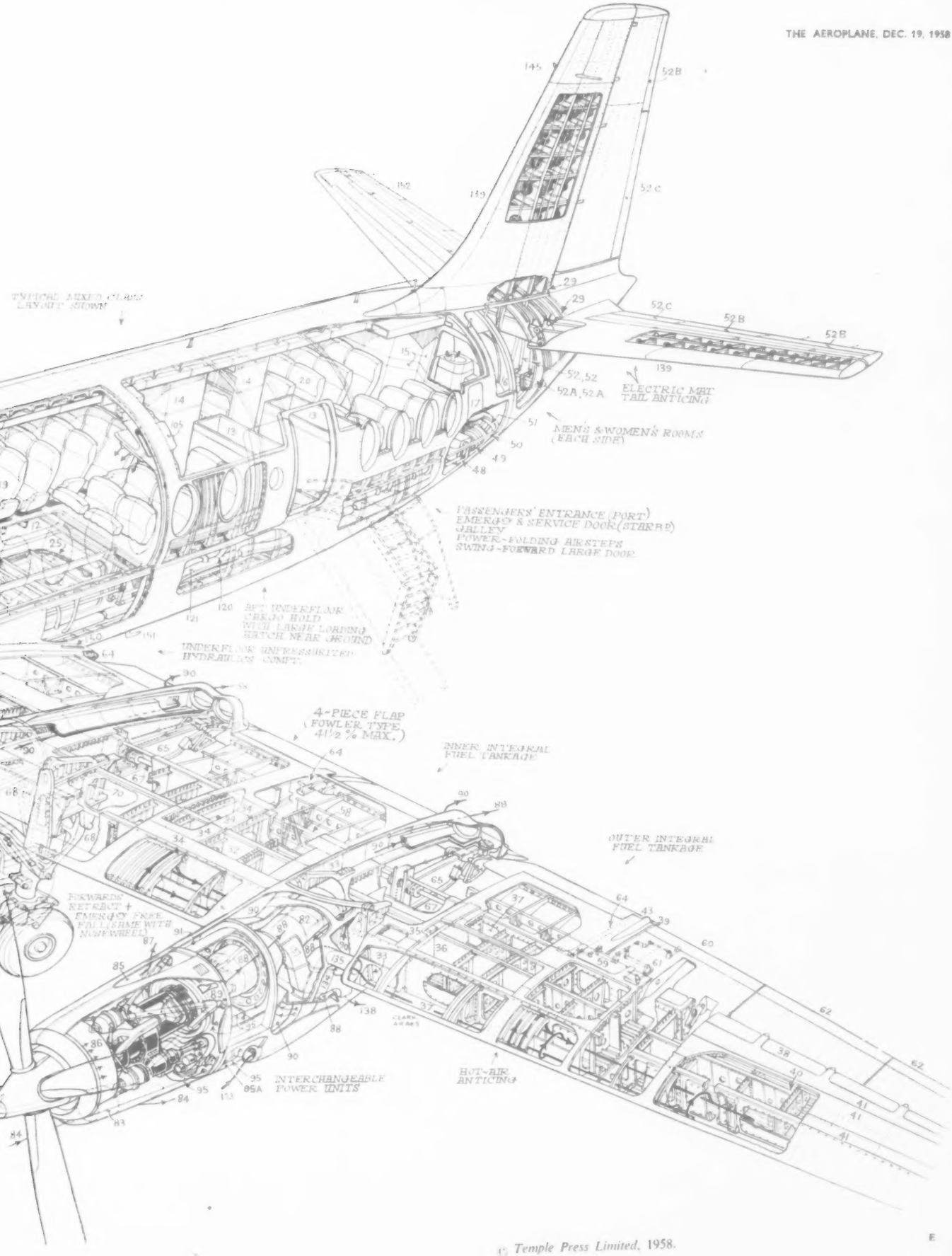
RS VANGUARD

urboprops




TYPICAL MIXED CLASS LAYOUT SHOWN
PASSENGERS' ENTRANCE (PORT)
EMERGENCY & SERVICE DOOR (STARBD)
GALLEY
POWER-FOLDING AIRSTEPS
SWING-FORWARD LARGE DOOR
AFT UNDERFLOOR CARGO HOLD WITH LARGE LOADING HATCH NEAR GROUND
UNDERFLOOR UNPRESSURIZED HYDRAULICS COMPT.
4-PIECE FLAP (FOWLER TYPE, 41½% MAX.)
INNER INTEGRAL FUEL TANKAGE
OUTER INTEGRAL FUEL TANKAGE
ELECTRIC MAT TAIL ANTICING
MEN'S & WOMEN'S ROOMS (EACH SIDE)
INTERCHANGEABLE POWER UNITS
HOT-AIR ANTICING

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VANGUARD DETAILS

Drawings by J. H. Clark, A.R.Ae.S.
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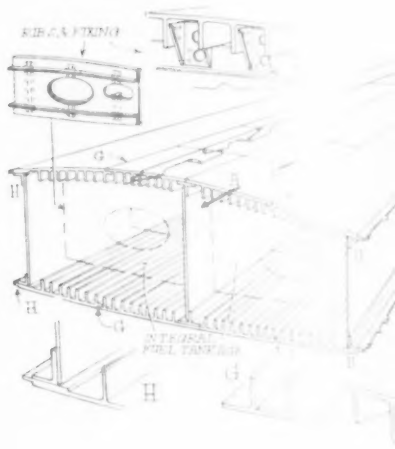
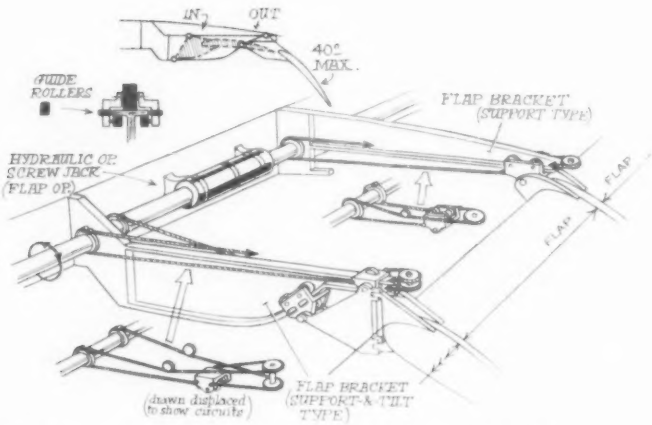
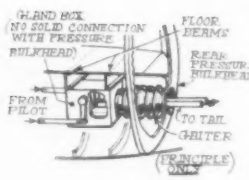
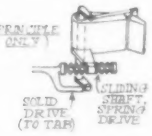


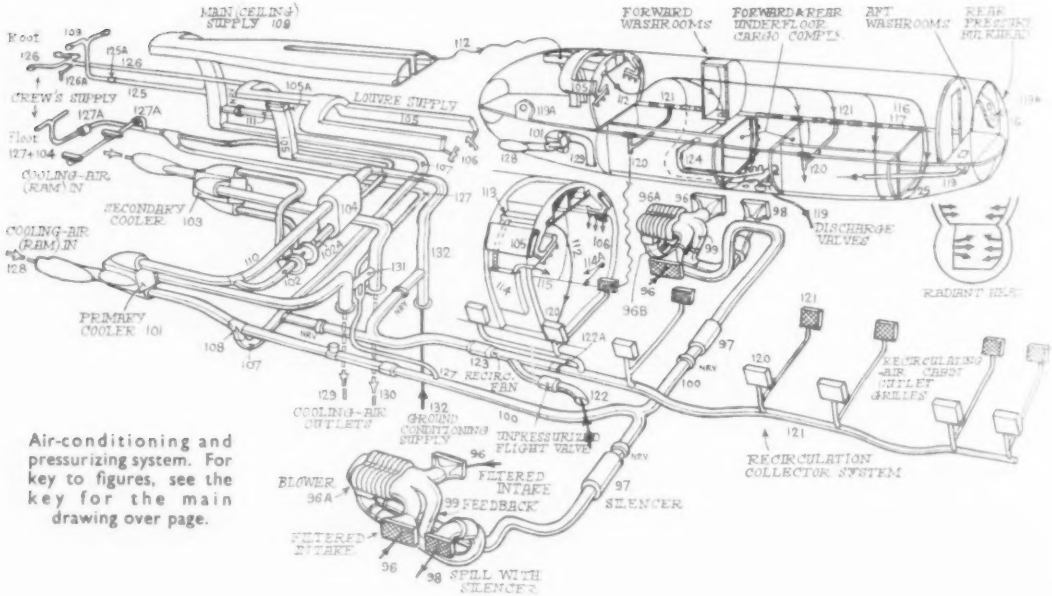
Above, integrally stiffened skins are used in the wing torsion box.



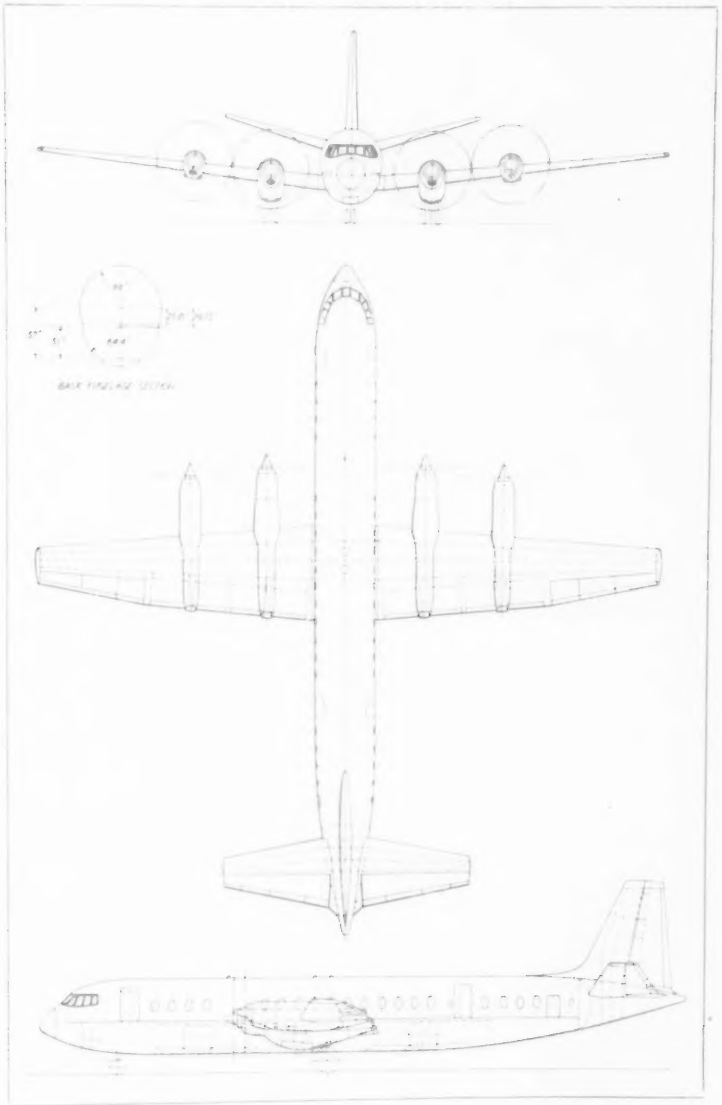




Left, flap-operating mechanism.



Air-conditioning and pressurizing system. For key to figures, see the key for the main drawing over page.



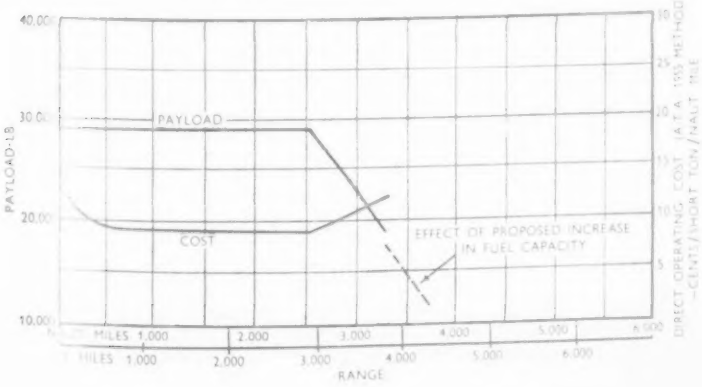
Powerplants
Four Rolls-Royce Tyne R.Ty. 11.
Take-off power each (I.S.A., s.l.): 5,525 e.h.p. at 15,250 r.p.m.
de Havilland four-blade reversing propellers 14 ft. 6 in. diameter.

Weights and Loadings
Basic operational: 83,500 lb.
Total fuel: 40,800 lb.
Mfrs. max. payload: 29,000 lb.
Max. take-off: 141,000 lb.
Max. landing: 121,000 lb.
Max. zero fuel: 112,500 lb.
Wing loading (max. t-o. wt.): 92.2 lb./sq. ft.
Wing loading (max. landing wt.): 79.2 lb./sq. ft.
Power loading (max. t-o. wt.): 6.37 lb./e.h.p.

Design Criteria
Design limits at 10,000 ft.: Vc=313 k. Vne=352 k. Vd=391 k.

Performance
Recommended cont. cruising speed (I.S.A.): 367 knots (at 20,000 ft. and 121,000 lb.); consumption: 710 Imp. gal./hr.; power: 13,500 r.p.m.
Approach speed (at max. landing wt.): 127 knots E.A.S.
Balanced field lengths (at max. t-o. wt.): At I.S.A. at sea level: 6,000 ft.
At I.S.A. +15°C. at sea level: 7,300 ft.
At I.S.A. at 5,000 ft.: 8,200 ft.
Landing distance from 50 ft. (unfactored, max. landing wt.): 3,300 ft.
Range (take-off to landing), still air, no reserves, I.S.A., max. fuel (5,100 Imp. gal.): 3,300 naut. mi. with 19,100 lb. payload at 350 knots (mean) at 30,000 ft. (mean).
Range (take-off to landing) still air, no reserves, I.S.A., with max. payload 2,540 naut. mi. at 343 knots at 30,000 ft.

Payload-range curve for the Vanguard with Rolls-Royce Tyne R.Ty.11 engines.



Dimensions
Span: 118 ft. 0 in.
Overall length: 122 ft. 10.4 in.
Overall height: 34 ft. 11 in.
Gross wing area: 1,529 sq. ft.
Sweepback: Nil.
Internal cabin dimensions:
Length (ex. flight deck): 90 ft. 0 in.
Max. width: 127 in.
Max. height: 86.5 in.
Max. usable floor area (ex. flight deck): 893 sq. ft.
Max. usable volume (ex. flight deck): 5,690 cu. ft.

Accommodation
Normal first-class: 97 (5 abreast)
Normal mixed: 114 (5 abreast)
Max. coach: 139 (6 abreast)
Volume of freight and baggage holds: 1,360 cu. ft. (2).

VANGUARD SUPPLIERS AND SUB-CONTRACTORS

A

A.E.I. Lamp and Lighting Co., Ltd. (lamps); Aero Controls, Ltd. (fasteners and universal joints); Aerolex, Ltd. (safety straps and harness); Aircraft-Marine Products (Gt. Britain), Ltd. (terminal tags); Air Service Training, Ltd. (blanking caps); Amplivox, Ltd. (headsets); George Angus and Co., Ltd. ("O" rings, oil seals, pulleys); Austenite, Ltd. (cyclic de-icing switches); Automotive Products Co., Ltd. (pumps, valves, couplings); A.V.A., Ltd. (anti-vibration mountings); Avery-Hardoll, Ltd. (filler caps); Aviation Developments, Ltd. (Pip pins, Avdel rivets); Avica Equipment, Ltd. (Flexflyte tubing); Avimo, Ltd. (pressure heads).

B

Barnet Instruments, Ltd. (pressure gauges); Belling and Lee, Ltd. (fuses, plugs, sockets); Bell's Asbestos and Engineering, Ltd. (sealing bands and sleeves); Besson and Robinson, Ltd. (relays); Sydney S. Bird and Co. (condensers); Bowden (Engineers), Ltd. (cables, ferrules); British Messier, Ltd. (choke valves, solenoids); British Thomson-Houston Co., Ltd. (circuit breakers, contactors, rectifiers); British Timken, Ltd. (bearings); S. G. Brown, Ltd. (handset blocks); Brown Brothers (Aircraft), Ltd. (Hi-Shear pins); Brush Electrical Engineering Co., Ltd. (fuses); Budenberg Gauge Co., Ltd. (pressure gauges); A. F. Bulgin and Co., Ltd. (lampholders, knobs); Burgess Products Co., Ltd. (micro switches, actuators).

C

Cable Covers, Ltd. (ferrules); Cannon Electric Co., Ltd. (plug, sockets, connectors); Castelco (G.B.), Ltd. (switches); Cathodeon, Ltd. (crash switches); Chelton (Electrostatics), Ltd. (aerials and accessories); Copeland and Jenkins, Ltd. (flight-deck heaters); C.W.C. Equipment, Ltd. (switches).

D

S. Davall and Sons, Ltd. (engine starting switch); Davies, Kent and Stewart, Ltd. (sockets); Davis and Timmins, Ltd. (push switches); Decca Navigator Co., Ltd. (navigator system); de Havilland Propellers, Ltd. (propellers, spinners); Delaney Gallay, Ltd. (heat-exchangers and fuel-tank protection blankets); Dowty Nucleonics, Ltd. (switches, indicators); Dowty Seals, Ltd. (sealing rings); Dunlop Rubber Co., Ltd. (Aviation Division) (pumps, valves, brake units, windscreen-wiper assemblies, main and nose wheels, tyres, flexible hose); Dzus Fastener (Europe), Ltd. (fasteners, grommets).

Godfrey/SRM screw-compressor Type 175.

E

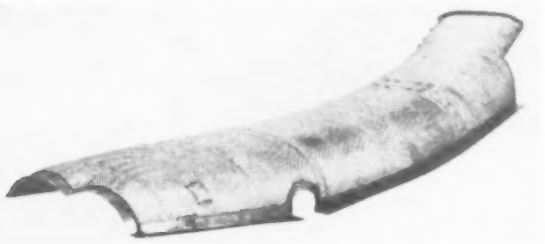
Electric Construction Co., Ltd. (push buttons); Elliott Bros. (London), Ltd. (fuel-flow indicators, amplifiers); English Electric Co., Ltd. (fuses); Ericcson Telephones, Ltd. (relays).

F

Ferranti, Ltd. (transformers, rectifiers); Films and Equipments, Ltd. (plugs, sockets); Flexello Castors and Wheels, Ltd. (castors); Flight Refuelling, Ltd. (couplings, bulkhead connectors, valves, indicators, switches); Fraser Speller Eng. Co., Ltd. (transformers); F. I. Products, Ltd. (spring clips).

G

General Electric Co., Ltd. (lampholders, relays, water heaters, fluorescent tubes, lamps, etc.); Glacier Metal Co., Ltd. (bearing plates, bushes); Gloster Aircraft Co., Ltd. (pilots' pressure and temperature control units); Sir George Godfrey and Partners, Ltd. (valves and silencers, axial fans, cold-air units, compressors); Graviner Manufacturing Co., Ltd. (fire extinguishers, Firewire detectors, sensing elements).



Delaney Gallay jet pipe heat shroud for the Tyne.

H

Harley Aircraft Landing Lamps (landing lamps); Harwin (Engineers), Ltd. (turret lugs); Hellerman, Ltd. (seals, bungs, glands, clips); Hendrey Relays, Ltd. (relays, rotary switches); High Pressure Components, Ltd. (charging valves); Honeywell Controls, Ltd. (micro switches, toggle switches, actuators); Hoffman Manufacturing Co., Ltd. (bearings).

I

Insuloid Manufacturing Co., Ltd. (clips).

J

Johnson, Matthey and Co., Ltd. (electrical contacts).

K

Kelvin and Hughes, Ltd. (altimeters, airspeed indicators, rate-of-climb indicator, turn-and-bank indicator); Walter Kidde Co., Ltd. (oxygen equipment); King Aircraft Corpn. (pipe clamps, couplings, fasteners, clips).

L

Lodge Plugs, Ltd. (thermocouples).

M

M.B. Metals, Ltd. (cockpit lamp holders); Magnetic Devices, Ltd. (plugs, sockets, relays); Manganese Bronze and Brass Co., Ltd. (Oilite bearings, bushes); Marconi's Wireless Telegraph Co., Ltd. (A.D.F. Equipment); Marston Excelsior, Ltd. (coolers); Measuring Instruments (Pullin), Ltd. (relays); Mechanism, Ltd. (strain gauge transmitters and recorders); Metalastik, Ltd. (bushes); Mullard, Ltd. (transistors); Murphy Radio, Ltd. (passenger address equipment).

N

N.S.F., Ltd. (switches); Normalair, Ltd. (air-conditioning and pressurization system).

O

Otter Controls, Ltd. (thermostats).

P

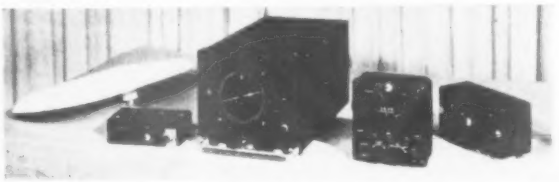
Paxe Engineering Co. (warning lights, switches, flasher units); Painton and Co., Ltd. (plugs and sockets); Parker (Toggles), Ltd. (toggle fasteners); Paton and Co., Ltd. (fuseholders); Penny and Giles (potentiometers); Permutit Co., Ltd. (carbon filters); Peto and Radford (dry batteries); Phillips Electrical Co., Ltd. (filaments); Pianoforte Supplies, Ltd. (fasteners and flush latches); Pioneer Oilsealing and Moulding Co., Ltd. ("O" rings); Plannair, Ltd. (fans and blowers); Plessey Co., Ltd. (actuators, terminal blocks, ferrules, plugs, sockets, inverters); Precision Rubbers, Ltd. (rubber seals); Pye, Ltd. (switches).

R

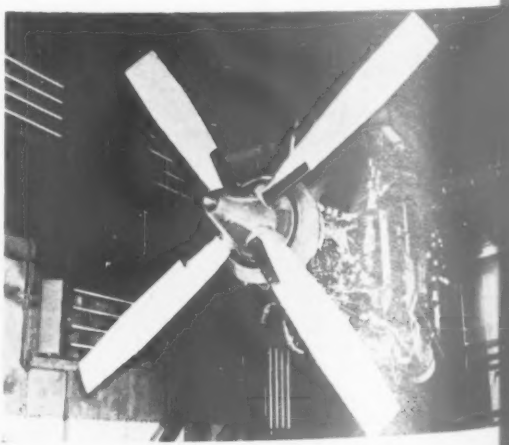
Rolls-Royce, Ltd. (Tyne turboprops); Rotameter Manufacturing Co., Ltd. (Rotameters); Rotax, Ltd. (circuit-breakers, relays, switches, voltage regulators); Rotol, Ltd. (gearboxes and drives).

S

Geo. Salter and Co., Ltd. (Truarc retaining rings); Sangamo Weston, Ltd. (transmitters, indicators, gauges, voltmeters, ammeters); Santon, Ltd. (switches); Saunders Valve Co., Ltd. (cocks, valves); SPE Co., Ltd. (fuel pumps and connections); Serck Radiators, Ltd. (oil coolers); Siebe Gorman and Co., Ltd. (oxygen bottles and gauges, seat belts and harnesses); Silentbloc, Ltd. (anti-vibration mountings); Simmonds Aerocessories Ltd. (Pacitor equipment, Spire studs, clips and nuts); Smiths Aircraft Instruments, Ltd. (automatic pilot, aircraft and engine instruments, flight system); Standard Telephones and Cables, Ltd. (RF, VHF, ILS, VOR equipment); J. Stone and Co. (Deptford), Ltd., (thermostat control); Superflexit, Ltd. (flexible hose, ferrules, p.t.f.e conduits).

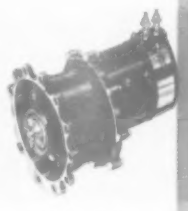


Marconi Type AD.721 ADF equipment.



de Havilland propeller and Rolls-Royce engine.

Joseph Lucas (GTE) simple flow control unit.



Rotax 28 volt 17.2 b.h.p. electric engine starter.

T

Tecalemit, Ltd. (grease nipples); Teddington Aircraft Controls, Ltd. (cyclic switches, pressure switches, bellows); Teleflex Products Ltd. (trimming controls); Transicoil Ltd. (reflowsol Ferry Herbert and Sons, Ltd. (eclipse Thermal Control Co., Ltd. (control units); Thermotank Ltd. (louvres); Thorn Electrical Industries, Ltd. (cockpit light fittings, navigation lights); Tinsley and Co., Ltd. (pressure gauges); Tinhill Engineering Co., Ltd. (diffusers); Trans Radio Ltd. (connector plugs); Treximport (anti-stall-warning equipment); Turner Electrical Instruments Ltd. (ammeters, voltmeters); Twiflex Manufacturing Co., Ltd. (hand pumps).

U

Ultra Electric Ltd. (intercommunication equipment).

V

Vokes, Ltd. (filters).

W

Walters Electrical Manufacturing Co., Ltd. (toilet units, reading lamps, warning signs); A. Wells and Co., Ltd. (anti-vibration mountings); Wellworthy, Ltd. (piston rings); Whitely Products, Ltd. (inspection bungees); Wilmot Breeden, Ltd. (locking assemblies); Worthington Simpson, Ltd. (centrifugal pumps).

Vanguard—First Survey . . . .

(*Continued from page* 890)

in the manner of the Vickers V.1000 (see THE AEROPLANE, January 13, 1956, for full description and cut-away drawing).

The third change is that the cockpit structure is integral with the fuselage and not a separate conical "blister" with unpressurized rear fairing as used on the Viscount. Cockpit windscreen frames for the Vanguard are machined from five main forgings.

Windows are similar to those of the Viscount, but the Vanguard has all its fuselage frames running full depth, and between each window are a number of vertical stringers for extra stiffening.

Design of the Wing

Wing structure of the Vanguard is of great interest and its design is very different from that of the Viscount. First and foremost, the choice of integral fuel tankage has had a major effect on the wing structure which, like the fuselage, has been designed to have a long fatigue life coupled with multiple-load-path characteristics.

Although the bag-tank system of the Viscount has proved eminently satisfactory, the Vanguard is a much faster aeroplane of greatly increased performance and no internal wing stowage can be wasted. Thus, integral tankage has been adopted so as to obtain maximum fuel capacity with the smallest possible wing required for aerodynamic reasons.

Having decided on this feature the logical next step was to fix upon skin panels with integral stiffening stringers. Use of three vertical shear webs provides a double torsion box in which any one main panel or shear web can fail without catastrophe, the structure in this emergency condition being stressed to take normal flight loads.

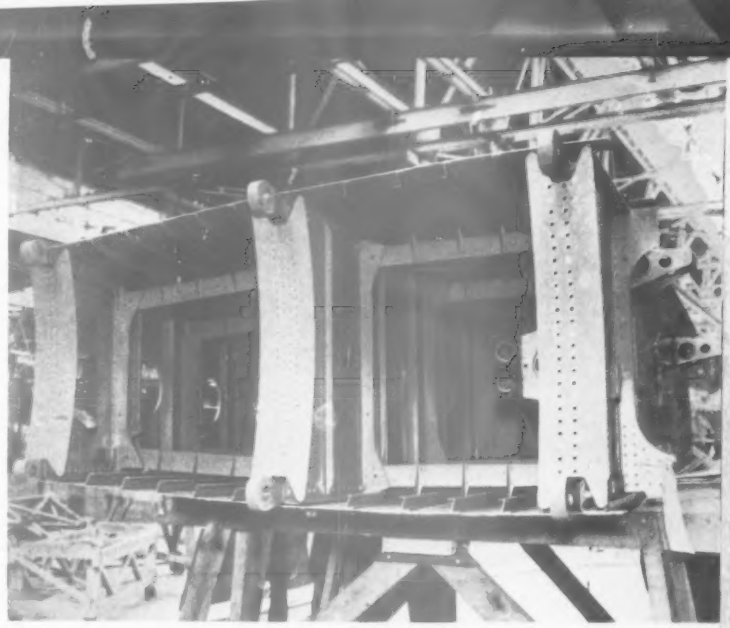
Effectively, the torsion box is one large integral fuel tank in which the latest fuel-sealing techniques have been used. There is a manufacturing joint just outboard of the outboard engine.

At the wing roots the mainplanes are attached by manufacturing joints to unpressurized stubs projecting from the fuselage sides, thus protecting the pressure cabin from the fuel-tank end ribs. The stubs are the outer ends of the wing centre-section which passes right through the fuselage complete with its three shear webs and integrally stiffened skin panels. This centre-section has no major cut-outs and has been made a heavily redundant structure to cope with the loads in this region.

Mountings for the four Tyne engines are fixed to the torsion box. At the inboard nacelles the mountings locate on two machined ribs which also carry attachments for the main undercarriage units.

AT THE READY.—When this picture was taken the first Vickers Vanguard was being readied for its maiden flight. Prominent is the double-bubble contour of the fuselage and the ram-air intakes under the nose. The fin top has not been fitted at this stage because of assembly hall limitations.

Photograph copyright "The Aeroplane"



TORSION TAKER.—A feature of the Vanguard wing and tail surface torsion boxes is the use of triple shear webs. The wing has integrally stiffened skin panels while the tail surfaces, as shown here, have riveted stringer-skin panels.

Detachable leading-edge sections are mounted on the front of the torsion box. On the rear are flap shrouds, aileron facings and mountings. Guide rails for the Fowler-type flaps are cantilevered from the rear face of the box. Although not part of the torsion box, the leading edge between the wing roots and inboard engine nacelles is stressed to take the loads which it must inevitably pick up. It is not anti-iced.

Tailplane and fin construction follow that of the wings in having double torsion boxes, but conventional riveted stringer-skin panels are used. Fin and tailplane shear webs are fixed to the same three fuselage frames, enclosed by the unpressurized tail cone.

At the roots of the fin and dihedralled tailplane the skin and stringers are replaced by three-spar construction so that each part can be detached from the tail cone.

Cabin Air Conditioning and Pressurizing

Maximum working pressure-differential for the Vanguard is 6.5 p.s.i. Mounted on the inboard engine accessory gearboxes are two Godfrey screw-compressor cabin blowers (THE AEROPLANE, March 29, 1957) which take air in through filters and supply it to primary silencers and thence to a common supply duct in the fuselage.

Full pressure can be maintained with either supercharger and sufficient air flow is provided to give a complete change of cabin air 20 times an hour.

Air is fed to the air-conditioning bay located around the

Vanguard—First Survey . . . .

(*Continued from page* 890)

in the manner of the Vickers V.1000 (see THE AEROPLANE, January 13, 1956, for full description and cut-away drawing).

The third change is that the cockpit structure is integral with the fuselage and not a separate conical "blister" with unpressurized rear fairing as used on the Viscount. Cockpit windscreen frames for the Vanguard are machined from five main forgings.

Windows are similar to those of the Viscount, but the Vanguard has all its fuselage frames running full depth, and between each window are a number of vertical stringers for extra stiffening.

Design of the Wing

Wing structure of the Vanguard is of great interest and its design is very different from that of the Viscount. First and foremost, the choice of integral fuel tankage has had a major effect on the wing structure which, like the fuselage, has been designed to have a long fatigue life coupled with multiple-load-path characteristics.

Although the bag-tank system of the Viscount has proved eminently satisfactory, the Vanguard is a much faster aeroplane of greatly increased performance and no internal wing stowage can be wasted. Thus, integral tankage has been adopted so as to obtain maximum fuel capacity with the smallest possible wing required for aerodynamic reasons.

Having decided on this feature the logical next step was to fix upon skin panels with integral stiffening stringers. Use of three vertical shear webs provides a double torsion box in which any one main panel or shear web can fail without catastrophe, the structure in this emergency condition being stressed to take normal flight loads.

Effectively, the torsion box is one large integral fuel tank in which the latest fuel-sealing techniques have been used. There is a manufacturing joint just outboard of the outboard engine.

At the wing roots the mainplanes are attached by manufacturing joints to unpressurized stubs projecting from the fuselage sides, thus protecting the pressure cabin from the fuel-tank end ribs. The stubs are the outer ends of the wing centre-section which passes right through the fuselage complete with its three shear webs and integrally stiffened skin panels. This centre-section has no major cut-outs and has been made a heavily redundant structure to cope with the loads in this region.

Mountings for the four Tyne engines are fixed to the torsion box. At the inboard nacelles the mountings locate on two machined ribs which also carry attachments for the main undercarriage units.

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Photograph copyright "The Aeroplane"

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Full pressure can be maintained with either supercharger and sufficient air flow is provided to give a complete change of cabin air 20 times an hour.

Air is fed to the air-conditioning bay located around the

Vanguard—First Survey . . . .

unpressurized nosewheel box. It is then conditioned by ram-air cooled heat-exchangers and a cold-air unit before passing to the passenger cabin via a roof duct.

From this duct some air is discharged directly into the cabin and some is taken behind the cabin wall-trim to heat the walls between the windows before being redirected into the cabin just below the roof racks.

Cabin air is exhausted through grilles at floor level and passed around the freight-hold linings before venting to atmosphere through discharge valves in the centre fuselage. On the flight deck, temperature variation is selected by mixing air from separate hot and cold supply ducts.

Cooling on the ground can be obtained using the normal air-cycle system by running one or both of the inboard engines and generator system or by a ground cabin-conditioning truck. In addition, a vapour-cycle cooling system may be fitted which can be operated by ground electrical supply.

Electrical and Hydraulic Systems

Following practice established with the Viscount, the Vanguard electrical system operates on 28-V. DC. Six Rotax variable-frequency 208-V. 50-kVA. alternators are driven by the engine accessory gearboxes, two by each outboard engine and one by each inboard engine.

Four alternators are coupled to transformer-rectifier units, each of which has an output of 500 amp. at 28-V. DC for the main electrical supply. Also, these alternators supply power for de-icing of their respective propeller blades, spinner and engine air intake.

The two other alternators are used for de-icing of the tail surfaces (Napier Spraymat) and windscreen (Triplex gold-film) and supply heating for cabin, flight deck, galley and freight holds. One alternator is used at a time for these purposes, the other acting as a spare.

Systems needing AC current are supplied from three inverters, two providing the main supply and the third being a standby.

The electrics bay is located in the lower fuselage forward of and under the wing centre-section, accessible through a hatch in the cabin floor. Six 24-V. batteries are mounted in this bay, remote from hydraulic pipe-lines and components. Each Tyne engine is fitted with a 17.2-b.h.p. Rotax electric starter.

The 3,000-p.s.i. hydraulic system is supplied by four engine-driven constant-displacement pumps. Undercarriage, flaps, wheel and propeller brakes, nosewheel steering and passenger stairs are all hydraulically operated.

Stainless steel is used for high-pressure pipe-lines and the low-pressure lines are of light alloy. The system can use either mineral-based fluid to specification D.T.D. 585 or fire-resistant fluid such as Skydrol 500, provided in the latter case that suitable oil seals, gaskets and gland packings are fitted to the components in the system.

Flying Controls

All three primary control surfaces of the Vanguard are servo-tab operated manually from the cockpit. Spring tabs are kept to the smallest possible size on all controls and weight is saved by using large geared tabs with as much fixed balance and integral balance as possible. The spring tabs on ailerons and rudder are also used for trimming purposes, as is the case with the Viscount rudder.

Accuracy of tab profile at the trailing edge is of great aerodynamic importance. For this reason a sandwich type of construction is used. This ensures that the skin is fully stabilized structurally at all times and cannot distort under severe suction loads. The elevators and rudder are also of this construction.

Following their use in the Viscount, the Westland-Irving type of sealed-balance "beaked" aileron has been adopted. As much aileron power as possible was the aim for the Vanguard, and the ailerons are consequently a relatively large percentage of the local wing chord. This has the effect that there is less room for internal balancing and the beak-to-chord ratio is reduced because of the chordwise physical limit of the rearmost shear web of the wing torsion box.

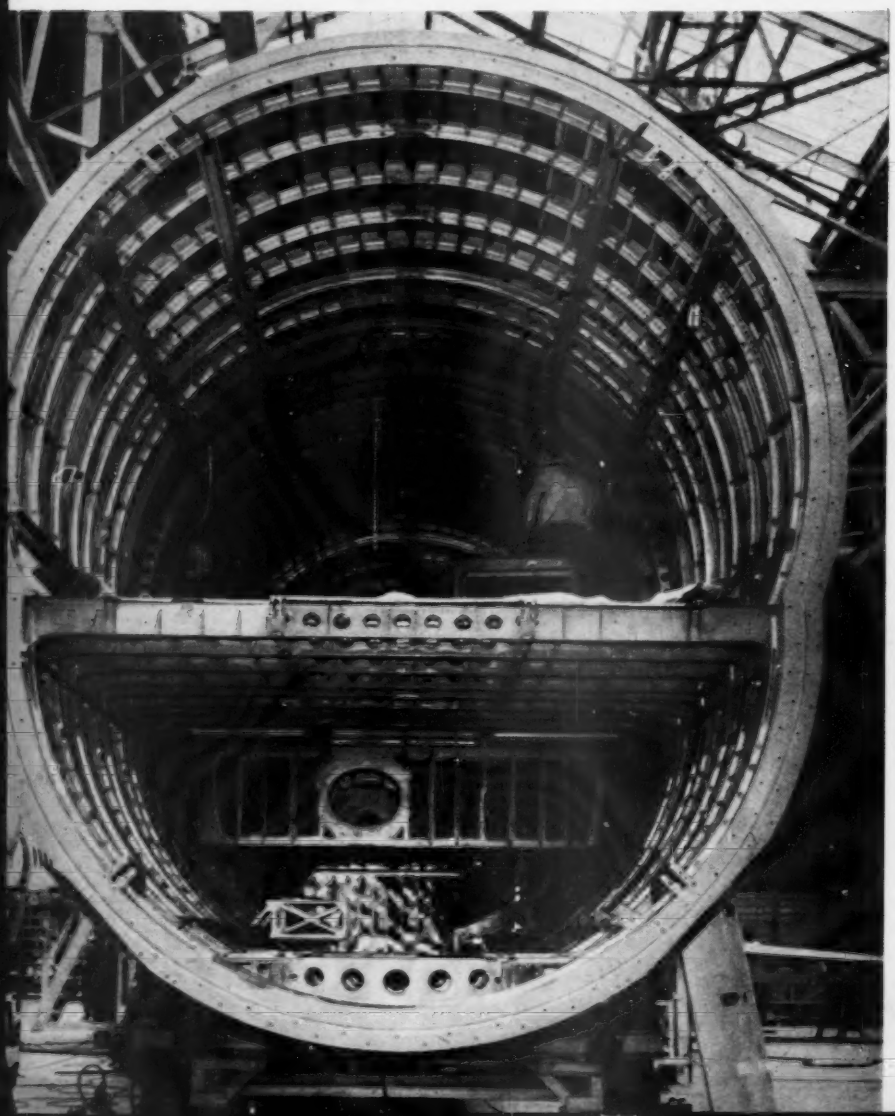
The three-piece ailerons are entirely tab-operated, each having geared and spring tabs. Large geared tabs cover the outer two-thirds of each aileron trailing edge. The inboard one-third is a spring tab. To avoid aileron up-float in high-lift conditions near the stall, a reverse-moment is applied by a down-float spring device.

Elevators have set-back hinges to give good stick-free stability. Much wind-tunnel work was done to investigate the effects of different hinge-line positions and elevator nose shapes, various combinations being tried out to keep a linear response of the control surface to control-column movement.

The final choice is for a finely pointed nose-profile and a hinge-line set back 42.6% of the chord from the leading edge. The balance is similar to that of the Viscount, but the nose is considerably sharper. Each elevator has three tabs; from root to tip they are respectively trim, spring and geared tabs.

More wind-tunnel work was needed to evolve a suitable symmetrical nose shape for the rudder. It is important to be able to use as much rudder movement as possible for the control of side-slip in an engine-out case with a cross-wind. The best linearity hinge-moment characteristic is required and a set-back hinge-line is again used.

(*Continued on page* 899)



DOUBLE BUBBLE.—Under-floor freight stowage is a particular feature of the Vanguard. This is a view of a section of fuselage built specially for structural testing.

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(*Continued from page* 898)

The geared tab of the rudder is trimmed automatically by an electric motor in the event of engine failure, but the pilot has also a manual trim-control wheel.

Fowler-type flaps are used with a large amount of rearward travel from the wing. There are four sections of flap on each wing, the maximum angle for landing being 40° and that for take-off 20°. The flaps move through 80% of the total travel in the first 20° of lowering and the remaining 20% in the final 20° of lowering for landing.

Double guide-tracks at the engine nacelles take out flap torque-reaction in the nacelle fairings, further single tracks taking shear only at other spanwise locations. A "fail-safe" type of system prevents asymmetry of flap operation at any time.

Wind-Tunnel Testing

Prior to adoption of a low-mid-wing layout for the Vanguard, three high-wing models were tested in low-speed and high-speed tunnels at Weybridge.

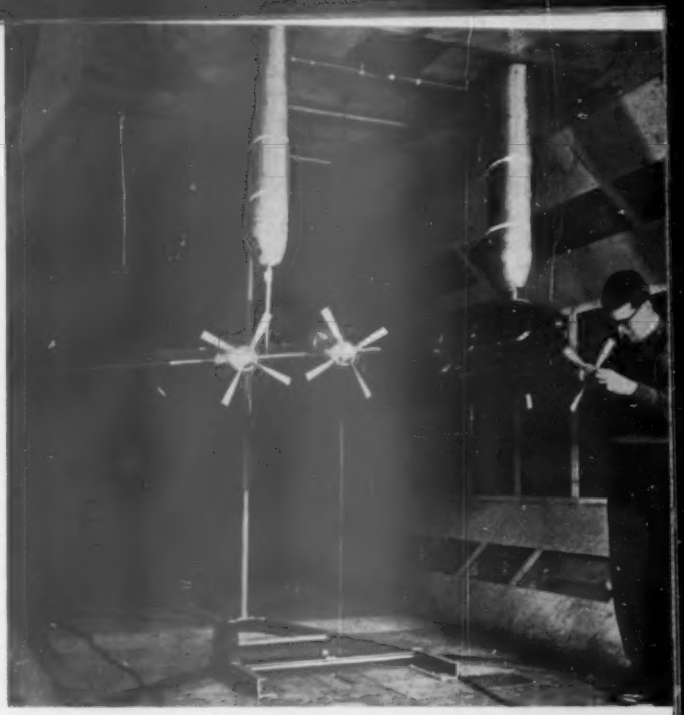
The first low-wing model had a straight trailing edge to the wing, with the quarter-chord line at right-angles to the fuselage. Another early feature was that the fuselage tail-cone stopped at the trailing edges of elevator and rudder.

Subsequently the wing was changed to its present compound-taper planform and the tail-cone was extended rearwards to give a smaller cone-angle. The need for the latter was shown by oil used in flow vizualization tests on a rear fuselage and tail-unit model.

A number of "partial" models were produced to study controls, flaps and local air-flow effects. Originally the rudder had a horn balance, but a flight trial installation on a Viscount was discouraging and the horn balance was dropped. It was later established that slight variations in manufacturing accuracy at the trailing edge were responsible for the results, small tab irregularities being capable of doubling the stick-load. This led directly to the use of honeycomb sandwich tabs to ensure accuracy of profile.

Various heights of tailplane were investigated. The high-wing projects had high-set cruciform tail units. The low-mid-wing layout required a correspondingly lower tailplane to which dihedral was added.

It comes as a slight shock to realize that high-speed effects are important for such a moderate-looking aeroplane as the Vanguard. In fact, the design diving speed is 450 m.p.h. E.A.S.



MODEL MIGHT.—This large wind-tunnel model is part of the exhaustive programme of aerodynamic investigation for the Vanguard. More than 75,000 man-hours have been spent on model manufacture for low- and high-speed tunnels.

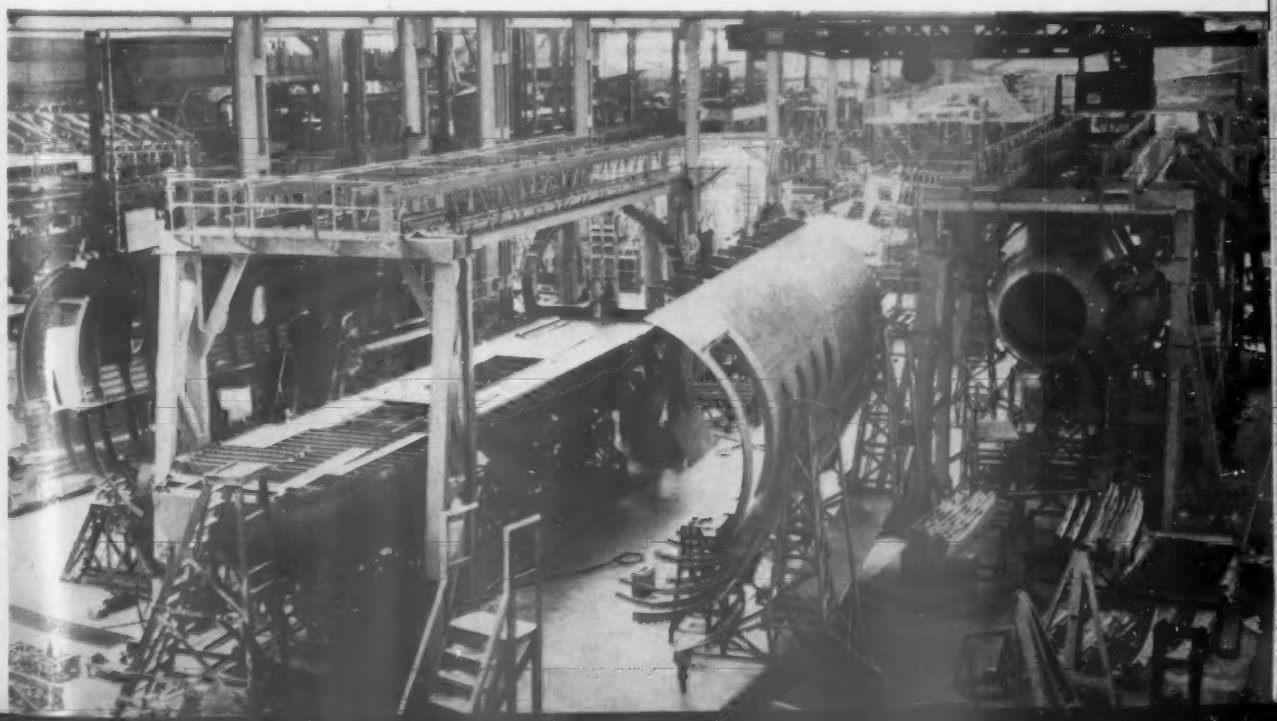
and it was necessary to take Schlieren interferometer photographs of a front-fuselage model to check that shock waves did not emanate from the fuselage nose in the region of the windscreen panels.

Pressure plotting of the complete aircraft wetted surface has been made on models and no major modifications in shape have resulted.

One test which is standard at Weybridge is that for twisting moment of the rear fuselage.

Model manufacture by Vickers-Armstrongs is a very advanced technique. Even so, more than 75,000 man-hours have been spent on making models of the Vanguard. This is partly explained by the limits of ±0.001 in. on a steel wing for the high-speed tunnel and ±0.005 in. on a mahogany wing for the low-speed tunnel.

In addition, a further 70,000 man-hours have so far been spent on model design, wind-tunnel testing programmes and reduction of results. This total is increasing and will continue to do so during the first year of flight testing. Wind-tunnel running time so far is about 1,500 hr.—D.G.



WEYBRIDGE JIGS.—Fuselage side panels are assembled onto the basic floor structure of the Vanguard. Complete nose and tail-cone sub-assemblies are added before the integral fuselage/wing centre-section is built on at final assembly.

Vanguard—First Survey . . . .

Turboprop Power by Tyne

FIRST commercial application of the Rolls-Royce Tyne turboprop is the Vickers Vanguard, in which four Tynes are the powerplant.

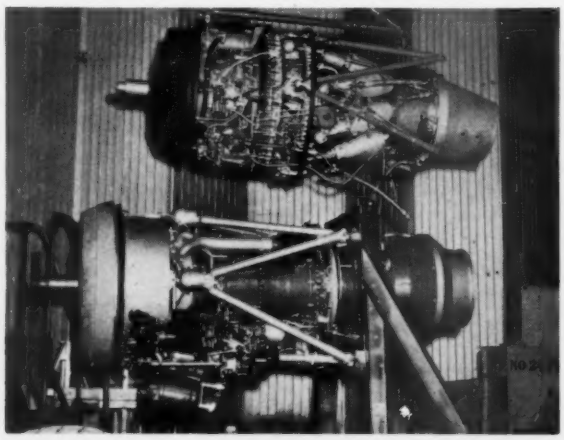
The Tyne is the first of the new generation of high-compression two-spool turboprops. It couples high performance with extremely good fuel economy. Full internal details cannot yet be given, although the main features of the engine were described in our issue of September 26.

Originally known as the R.B. 109, the Tyne design began in 1953 and its layout owed much to work on the two-spool Conway by-pass turbojet.

Tyne design started where that of the Dart left off. The Dart made good use of centrifugal-compressor technology taken to the Welland and Derwent turbojets from experience with superchargers for piston engines. The Tyne similarly profits from Rolls-Royce experience with the axial-compressor Avon turbojets and the more advanced aerodynamics of the two-spool Conway. The Tyne first ran in April, 1955, and gave its design rating of 4,000 s.h.p.

A measure of the advances made in turboprop design is that the Tyne R.Ty.1 will enter service with the first Vanguards at a power of 4,985 e.h.p. at 15,250 r.p.m. compared with 1,400 s.h.p. at 14,500 r.p.m. for the first Dart to go into service, the R.Da.3 Mk. 505 (see THE AEROPLANE, February 28, 1958, for a full account of Dart history and design details of the R.Da.7 engine).

The Tyne R.Ty.11, which will be fitted to later Vanguards, has a take-off power of 5,525 e.h.p. at 15,250 r.p.m. Later variants will be developed to much higher powers with changes only in materials and cooling.



BIG BROTHER.—Relative sizes of the two-spool Rolls-Royce Tyne R.Ty.1 (lower) and the Dart R.Da.7 single-spool engine are shown above. Below and on the facing page are further views of the Tyne.

Engine Performance and Layout

Two-spool engines offer the advantages of higher thrust and better fuel economy than those of single-spool design because of the far higher pressure-ratios attained. It is quite practicable to have a high-compression single-spool engine, but flexibility of handling at low flight-speeds can then be achieved only by adoption of variable-incidence inlet guide-vanes and stator blades (as used in the G.E. J79 and T58 in the U.S.A.).

The Tyne has a pressure-ratio of 13 : 1 compared with 5.75 : 1 for the Dart R.Da.7 and 6.35 : 1 for the R.Da.10. The R.Ty.11 has a specific fuel consumption of 0.480 lb./e.h.p./hr. (0.499 for the R.Ty.1) at take-off power and 0.388 lb./e.h.p./hr. (0.405 for the R.Ty.1) when cruising. The Dart's much earlier design is reflected in an s.f.c. of 0.66 lb./e.h.p./hr. for the R.Da.7 and 0.64 lb./e.h.p./hr. for the R.Da.10 at take-off power, although these figures are still very good when compared with other turboprops of more recent vintage.

The de Havilland propeller is driven by the low-pressure spool which has a six-stage axial compressor and three-stage turbine. The high-pressure spool has a nine-stage compressor and a single-stage high-pressure turbine. Inside the annular combustion system casing are 10 flame tubes.

Titanium alloy is used for the first seven rotor stages of the high-pressure compressor, the last two stages being of steel to withstand the highest temperatures. The stator blades of this compressor are also of steel.

In the low-pressure compressor the inlet guide-vanes and first

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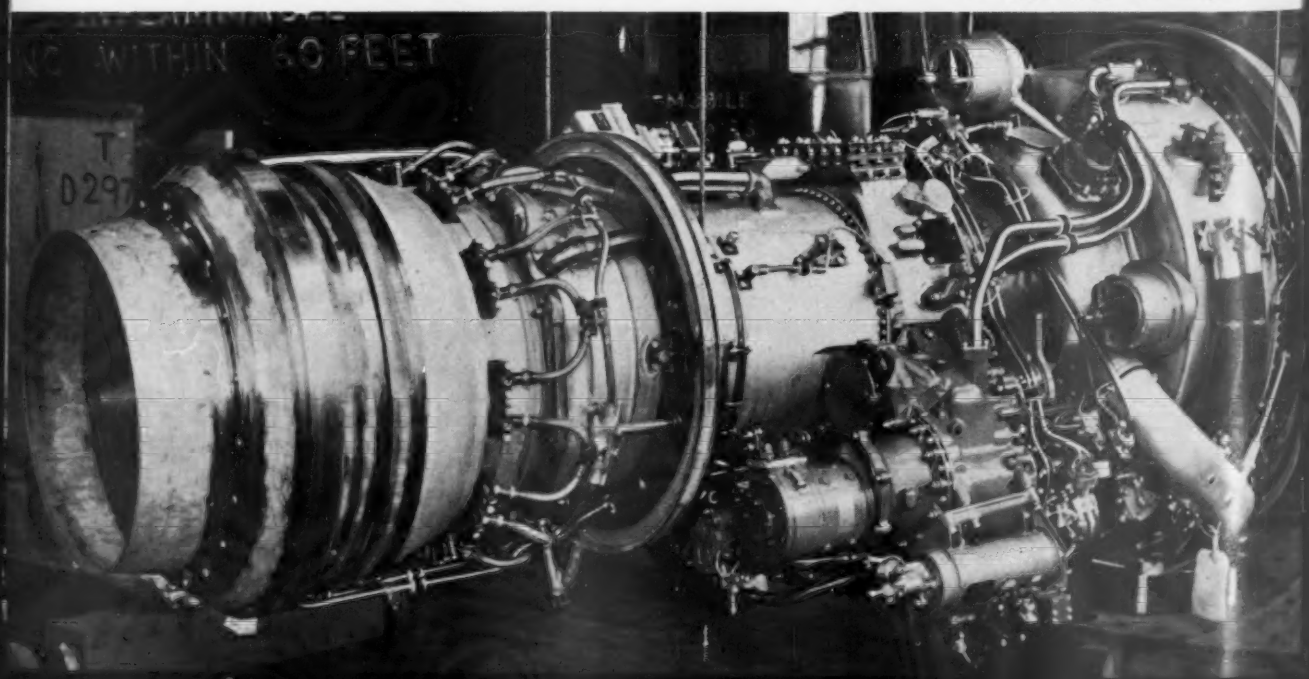


row of stator blades are of hollow steel construction. They are supplied with hot air for anti-icing through a valve "scheduled" for economic use of hot air. Anti-icing air is also supplied to the leading edges of the struts of the air intake, of which three form the lower conduits for propeller services. Other stator and all rotor blades are of light alloy.

In accordance with well-established Rolls-Royce practice, all rotor blades are pinned to their discs. Engine casings are mainly of steel. Turbine inlet nozzles and blades of the high-pressure turbine are air-cooled.

Around the air intake is a steel annular oil tank. Accessories on the starboard side of the engine are driven from the high-pressure spool and those on the port side—including the propeller control unit (PCU)—by the low-pressure spool. Any shaft failure in the engine would not endanger the PCU because it is driven from the forward side of the propeller reduction gear. A propeller-synchronizing alternator is driven at four times propeller speed.

One major problem of using a high-pressure-ratio engine is the surplus low-pressure air produced at low power, when on the approach, which is far in excess of the requirements of the high-pressure compressor. For this reason there is a bleed-valve on the casing of the low-pressure compressor.

Reduction-gear ratio of engine to propeller speed is 0.064 : 1, giving a cruising helical tip Mach number of 0.82 for the 14-ft. 6-in. diameter de Havilland propeller on the R.Ty.1 and M= 0.89 for the R.Ty.11. The reduction gear consists of epicyclic trains with helical gearwheels.

Control of the Tyne is by one lever for mechanical trimming of the fuel flow, operation of the high-pressure fuel shut-off cock and for feathering; and a second lever for throttle and engine speed control. The fuel-flow control system is closely related to that of the Dart, but has certain additional features involved, such as the low-pressure compressor bleed-valve.

The propellers for the Tyne have four forged aluminium-alloy blades mounted in two-piece barrel hubs. Safety and other features of the propeller design have been worked out with close co-operation between de Havilland Propellers, Ltd., and Rolls-Royce, Ltd.

The amount of negative torque produced by the engine is restricted by an automatic drag-limiting system. Automatic feathering is available in the normal flight regime with automatic pitch-coarsening at all other times.

The usual D.H. hydraulic pitch-lock is incorporated in the pitch-change mechanism and holds blade-angle to that obtaining at the moment of oil-supply failure to the propeller.

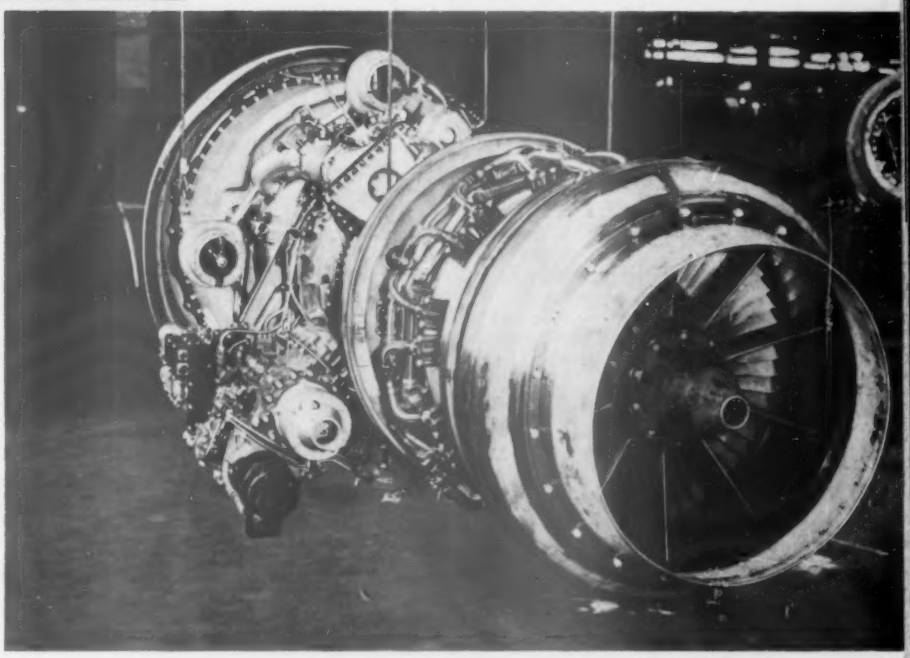
There is also a mechanical overspeed lock inside the pitch-change mechanism. This consists of two dogs or toothed plates held out of mesh by oil pressure and engaging under spring-loading if oil pressure fails. One plate rotates with the propeller shaft and the other with the moving cam of the pitch-change mechanism.

Should a propeller overspeed occur which is not due to oil failure, a small flyweight type of spring-loaded governor is acted upon by centrifugal force above a pre-set rotational speed and opens a valve to dump oil and thus allow the lock plates to engage as the oil pressure drops.

A flight fine-pitch stop limits blade movement in the fine-pitch direction and prevents entry into the ground-running range which would create undesirably high "discing" drag.

Propeller-pitch control on the ground at negative blade angles for reverse-thrust (or positive angles for taxi-ing) is of the "β-control" type from flight fine-pitch stop at 10° right through to maximum reverse pitch at −29°. With "β-control" the blade angle is positively and continuously controlled, the PCU acting as part of a precision servo loop while r.p.m. are maintained at the correct schedule by a fuel governor. Blade angles at the 72-in. radius station are 79°, feather; 10°, flight fine-pitch stop; −7°, ground fine-pitch position (ground idle); and −29°, full reverse-thrust stop.

Disastrous overspeeding of the engine in the event of turbine shaft failure is guarded against by an emergency fuel cut-off system. This is operated by the low-pressure turbine which, in the event of an overspeed, starts to go faster than the shaft by which it drives the low-pressure compressor and unscrews a nut. This causes the fuel supply to be cut off by a cable and bell-crank linkage. Compared with the 3 sec. needed for the turbine to burst, the fuel cut-off operates within $^{1}/_{10}$ sec.



Photographs copyright "The Aeroplane"

Tyne Development and Potential

Painstaking and exhaustive development of a completely new engine is never, wisely, a quick business, and Rolls-Royce have maintained their customary caution in this respect. However, it appears that a few changes have been made since the Tyne first appeared.

One such revision was redesign of the high-pressure compressor to avoid surging. Not unexpectedly, the weight has crept up with alterations and additions inevitable in engineering development. The most important thing is that the power has steadily gone up since the first R.B. 109 gave its design power of 4,000 s.h.p. and the s.f.c. has gone down.

Flight testing has been done in Lincoln and Ambassador test-beds. A second Ambassador will be operated intensively by B.E.A. to attain 10,000 hr. flying before a Vanguard carries a fare-paying-passenger. In addition to the Vickers Vanguard, the Tyne is specified for the Canadair CL-44D transport. This version will be the R.Ty.12 of 5,300 s.h.p. and 1,120-lb. thrust at take-off, or 5,730 e.h.p., driving a 16-ft. diameter de Havilland propeller.

The Tyne would obviously be a highly suitable engine for any future strategic freighter, and as such has been considered for the Blackburn B.107 and Short Britannic. Twin-Tyne powered versions of the Armstrong Whitworth Argosy and Fairey Rotodyne have also been projected.—D.G.

The Fighting Services

Malayan Honours

IN the London Gazette for December 9 a Special Malayan Honours List for distinguished service announces the following awards:—

Order of the Bath (Military Division)

As Companion: Air Vice-Marshal V. E. Hancock, C.B.E., D.F.C., R.A.A.F., Air Officer Commanding No. 224 Group, Malaya.

Order of the British Empire (Military Division)

As Commander: Group Captain R. J. P. Prichard, O.B.E., D.F.C., A.F.C.

Distinguished Flying Cross

Flt. Lt. J. Hubicka, Flt. Lt. J. H. Liversidge, A.F.C., Flt. Lt. C. E. Slater, Capt. M. G. Badger, Royal Engineers, Capt. H. G. Crutchley, R.A.

Distinguished Flying Medal

Staff Sgt. R. W. Bowles, Army Air Corps.

British Empire Medal (Military)

Flt. Sgt. A. N. Patient.

Cyprus Helicopter Operations

NOW entering its third year of operations in Cyprus, No. 284 Squadron, equipped with Bristol Sycamores, has flown over 16,000 sorties and logged more than 8,000 hr. During this period of active service the Squadron has developed two important techniques—night-flying and the dropping of troops in mountainous terrain.

It has dropped more than 3,270 troops in anti-terrorist operations and trained a further 13,000 in the art of descending ropes from hovering helicopters. The number of casualties evacuated from hills and forests totals more than 220, including those seriously wounded in Eoka ambushes. Apart from its normal rôles of search and rescue and reconnaissance, No. 284 Squadron has helped to fight forest fires and has dropped 113 tons of food, ammunition and stores to members of the security forces in the mountains. In recognition of the part played by the Squadron in the Cyprus emergency, six of its members have recently received honours and awards.

Passing-Out Parades

APPROXIMATELY 700 aircraft and administration apprentices and boy entrants are due to complete their training at Technical Training Command schools before the end of this year. The passing-out parade of the 31st Entry at the Administrative Apprentice Training School, R.A.F. Hereford, on December 18 was to be before the A.O.C.-in-C., Technical Training Command, Air Marshal Sir Arthur McDonald. The school, commanded by Wg. Cdr. W. H. Bentley, O.B.E., is to be transferred to R.A.F. Bircham Newton in January of next year. This station is also the home of the Officers' Advanced Training School.

Air Marshal H. D. Jackman, A.O.C.-in-C., Maintenance Command, was to be the reviewing officer at the final parade of 41 aircraft apprentices of the 82nd Entry, No. 1 Radio School, R.A.F. Locking, on December 16. Two hundred aircraft apprentices of the 82nd Entry at No. 1 School of Technical Training, R.A.F. Halton, were to have Air Marshal Sir Raymund Hart, Controller of Engineering and Equipment at the Air Ministry, as their review officer at their graduation parade on December 17. During last week 260 boy entrants of the 31st Entry at No. 2 School of Technical Training at R.A.F. Cosford, and 220 boy entrants of the 31st Entry at No. 4 School of Technical Training, R.A.F. St. Athan, had their passing-out parades before Air Vice-Marshal R. B. Lees, Senior Air Staff Officer, Fighter Command, and Air Marshal Sir Arthur McDonald respectively.

TAKING OVER COMMAND.—The new C.-in-C., Middle East Air Force, Air Marshal W. M. L. MacDonald, was ceremonially installed in his headquarters at R.A.F. Episkopi on November 27. Air Marshal MacDonald (right) is seen with Air Vice-Marshal L. W. C. Bower, the Deputy C.-in-C., after the ceremony.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Group Captains: W. G. Devas, D.F.C., A.F.C., to R.A.F. Thorney Island, to command; A. R. D. MacDonell, D.F.C., to R.A.F. South Cerney, to command.

Wing Commanders: D. H. Beckett, O.B.E., to Headquarters, British Forces Aden Peninsula, for technical staff duties; G. Davidson to Allied Air Forces Central Europe, for staff duties; K. J. B. Dunlop, O.B.E., to R.A.F. Dishforth, for technical duties; R. A. B. Ellis, R.C.A.F., to Headquarters, Fighter Command; J. B. Evans, to R.A.F. Valley for technical duties; M. G. L. Foster, A.F.C., to R.A.F. Uxbridge, as President of the Ground Selection Board; J. Hurry, D.S.O., D.F.C., to R.A.F. Bruggen, 2nd T.A.F., Germany, to command No. 80 Squadron; C. J. Mackenzie, D.F.C., A.F.C., to Air Ministry for duty in the Department of the C.A.S.; P. A. C. McDermott, D.F.C., D.F.M., to Headquarters, Bomber Command, for administrative planning duties; E. H. Maule to Ministry of Supply; F. G. B. Randall to No. 12 School of Technical Training to instruct.

Squadron Leaders: E. W. Cropper to the R.A.F. College, Cranwell, for administrative duties (with acting rank of Wg. Cdr.); W. E. D. Makin, D.F.C., to the U.S.A.F. Missile Test Centre, Patrick, A.F.B., Florida (with acting rank of Wg. Cdr.); K. R. Penry to R.A.F. Lyneham as officer in charge of administration (with acting rank of Wg. Cdr.); L. G. A. Reed, M.V.O., D.F.C., to No. 120 Squadron to command (with acting rank of Wg. Cdr.); T. H. Blackham, D.F.C., to Northern Army Command as liaison officer (with acting rank of Wg. Cdr.); G. E. S. Bumstead to Air Ministry for duty in the Department of the C.A.S. (with acting rank of Wg. Cdr.); W. D. Hooper, A.F.C., to the staff of the Chief of Defence (with acting rank of Wg. Cdr.); J. H. Lewis, A.F.C., to Air Ministry for duty in the Department of the Air Member for Personnel (with acting rank of Wg. Cdr.).

ROYAL VISIT.—As part of his recent tour of Aden, H.R.H. The Duke of Gloucester visited M.E.A.F. units at R.A.F. Khormaksar. Below, His Royal Highness inspecting Valettas and Beverleys of No. 84 Squadron, he also saw Venoms of No. 8 Squadron.

Book Reviews

AIRSHIP, AEROPLANE, AIRCRAFT. Studies in the History of Terms for Aircraft in English. By Svante Stubelius. 342 pp., 6 in. by 9¼ in. Almquist and Wiksell, Stockholm. Price, Swedish Kr. 25.

A FEW years ago a modest-looking young man arrived in the library of the Royal Aeronautical Society and diffidently asked for permission to use it for research. It transpired that he was a Swede who had spent some time with the Swedish airlines as an English interpreter and tutor, and it was his intention to write a thesis on the origins of aeronautical terms for his Ph.D. at Gothenburg.

The first part of this thesis, entitled as above, has now been published. The close-print pages are divided into 27 chapters and a bibliography. The chapters have such headings as Flying Ship, Boat; Flying Boat, etc., Aeronef, Aeroplane, Biplane, Airplane, etc., and to get his origins Stubelius spent time studying in New York, London and Paris.

It would be foolish to quote from the book since every definition and word-history has been gone into with the greatest detail. It is doubtful if there has ever been a work of greater scholarship and erudition in our science—certainly not in its etymology. This, with its forthcoming companion "Balloon, Flying-machine, Helicopter. Further Studies in the History of Terms for Aircraft in English," will undoubtedly become one of the classics of aeronautical literature, and those whose interest lies in the historical side of aeronautics owe a debt to Svante Stubelius for the years he spent living on a shoe-string to produce a work that should provide the last word on aeronautical derivations.

A 12-page bibliography averaging 20 references to the page rounds off a fine work of reference.—F.H.S.

HANDBOOK OF THE AIRCRAFT INDUSTRY. Edited by J. L. Nayler and T. F. Saunders. 341 pp., 5¼ in. by 9 in. Illustrated. George Newnes, Ltd. Price 35s.

ONE of the series of Newnes' industrial handbooks, this survey contains articles by no fewer than 16 specialists, among whom can be found some of the leading names in the aircraft industry. The book is in eight parts, starting with an introductory section giving details of the industry and the careers it offers. Part 2 is a historical section; Part 3 covers various aspects of aeronautical engineering in eight separate chapters. Part 4 deals, in two chapters, with research and development and nuclear power; Part 5 covers guided missiles, and Part 6, civil aviation. There is a pictorial guide to modern aircraft as Part 7. And the book is rounded off with some useful technical and general data.—F.T.M.

FLYING WITNESS: HARRY HARPER AND THE GOLDEN AGE OF AVIATION. By Graham Wallace. 272 pp., 5¼ in. by 8¼ in. Illustrated. Putnam and Co. Price 25s.

DO NOT be put off by the title of this excellent little book in the belief that it is "just another" book about Harry Harper—the real clue is in the second half of the sub-title. Harry Harper is himself part of the Golden Age and far too famous to need personal publicity in his distinguished latter years (one cannot say "retirement" or "old age" for at 78 he is actively alert and as young as he feels).

Mr. Wallace brings the reader to all the great aerial occasions between 1906 and 1914, nearly all of which were personally witnessed by Harry Harper. This book could have been a mere catalogue of extracts from the *Daily Mail* and as such would have formed a convenient compendium for archivists, young and old; but Mr. Wallace has skimmed the cream of the Press cuttings and woven them into a vivid and compelling narrative which brings the reader personally to each event, watching over Harry's shoulder or even, sometimes, arriving there first and anxiously waiting for his masterly, but never exaggerated, commentary.

It goes without saying that there is no major historical discovery to be found in these pages, for the World's first air correspondent had a keen eye for significance, far more valuable than a mere nose for news. But the author has spiced his narrative with excellent pen-portraits of the famous pioneers of aviation whose names are so often no more than labels but in this book acquire personalities, physiognomies and family backgrounds. This effect is enhanced by many lively dialogues and quotations. There are, inevitably, one or two errors, but none serious or misleading, except, perhaps, the reference on p. 44 to Santos Dumont's "14-bis" as the "infuriated grass hopper"; since this soubriquet is correctly ascribed on p. 188 to the "Demoiselle" one feels that it should have been excised from the earlier page.

This is, as the publishers claim, a source book of great value and deserves a place on every bookshelf which already contains Charles Turner's "The Old Flying Days" or Dallas Brett's "History of British Aviation," to which it is an essential complement. Harry Harper's first interest in flying was inspired some 60 years ago by John Wise's ambition to cross the Atlantic by balloon, and one hopes for his sake, if for no other, that he will be able to witness the successful accomplishment of this feat by "The Small World," even if he is denied the prospect of men "all among the little stars and sailing round the Moon."—SENRAB.

BRASSEY'S ANNUAL—The Armed Forces Year Book—1958. Edited by Rear Admiral H. G. Thursfield; Assistant Editors, Brig. C. N. Barclay and Air Vice-Marshal W. M. Yool. 390 pp., 6 in. by 9¼ in.; plus 12-page index. Illustrated. William Clowes and Sons, Ltd. Price 63s.

THIS 69th volume of "Brassey's Annual" is overshadowed by the implications of the strategic and tactical nuclear-weapon developments of our time. Here, in this compact form, are 29 articles by specialist writers concerned with the study of each (and in a few cases all) of the three Services; three are from American contributors.

What strikes this reviewer in his examination of these pages is the lack of promulgation of a strategic policy to meet the immensely more powerful weapons already produced and in course of development. It appears that the tremendous tactical fire power of the new weapons has driven thought into analyses of the field organization to use them and give protection against them when used by the enemy, into defensive measures for the protection of the longer-range bomber and missile bases, and into consideration of what is called the "balanced fleet."

There is evidence of confusion of thought over the place of what has hitherto been called *air power* in the reorganized tactical forces on land and sea. The intention (if these writers are shadowers of official ideas, as most of them appear to be) seems to be to cast all the tactical Air Force weapons and units into the land and sea battles, and segregate the strategic long-range bombers and ballistic missiles into a separate force. It is disturbing to find that there is no cohesion of thought over their combined use. Saundby goes further by suggesting that ballistic missiles fired from submarines should be under the operational control of the Air Ministry.

Everywhere the object is defined as the prevention of major war and the containment of limited wars. With such an object we shall arrive nowhere. We shall be always on the defensive. Yet these writers reflect Government views as expressed in the Command Papers and Service Estimates included in the reference section of the volume.

The lesson which a study of this valuable annual drives home is the need for objective leadership among the Western Powers. The idea that we must remain in the strategic vacuum herein propounded, until at some vague date-line the Communist division of the World develops into a less aggressive, less antagonistic force, so that we can snuggle into the same political bed together, can only encourage Khruschev, Mao tse-Tung and Nasser.

For the younger student, the junior officer, there is much of value in this year's annual. He will find epitomized up to mid-1958 all he wants to know of current developments within his realm of responsibility, backed by reference tables and documents. The senior officer, the high official, the World thinker, must turn elsewhere for stimulation into channels of thought leading towards better balanced values of returns for the great expenditure of treasure on the present development of weapons.—NORMAN MACMILLAN.

Publications Received

GREAT ESCAPE STORIES. Edited by Eric Williams. 256 pp., 5¼ in. by 8¼ in. Illustrated. Weidenfeld and Nicolson. Price 12s. 6d.

JAHRHUNDERT DER RAKETEN. By Heinz Gartman. 320 pp., 6¾ in. by 8¾ in. Line and half-tone illustrations. Verlag Paul Muller. Price 21s. 6d. (12 DM.) (In German.)

LE TURBOREACTEUR ET AUTRES MOTEURS A REACTION. By A. Kalnin and M. Laborie. 400 pp., 6 in. by 9¼ in. Illustrated. Dunod, Paris.

THE PREDICTION OF BALLISTIC MISSILE TRAJECTORIES FROM RADAR OBSERVATIONS. By Irwin J. Shapiro. 208 pp., 10 in. by 7¼ in. McGraw-Hill Book Co. Price 54s. 6d.

UPPER AIR TEMPERATURE OVER THE WORLD. By N. Goldie, B.Sc., J. G. Moore, B.Sc., and E. E. Austin, M.A. 228 pp., 11 in. by 8 in. Illustrated. H.M.S.O. Price 30s.

WHO'S WHO IN WORLD AVIATION AND ASTRONAUTICS. 497 pp., 6 in. by 9¼ in. American Aviation Publications, Inc.

Flying the Jodel D.117

By John Fricker

AS the British aircraft industry has largely ignored the light aeroplane in the post-War years, and the very desirable mass-produced American machines are out of reach of private owners and clubs because of currency restrictions, a number of Continental designs are becoming of increasing appeal in this country. In particular, the French have produced several ultra-light aircraft which combine performance with excellent economy through skilful airframe design and the use of well-tried American flat-four powerplants.

One of these designs—the Emeraude—(described in THE AEROPLANE of November 21), is now being built under licence in Britain, and has an almost identical specification to the Jodel D.117, which is being made available to prospective customers in the U.K. and Commonwealth by Rollasons of Croydon. Rollasons are agents for the Société Aéronautique Normande (S.A.N.) of Bernay, who are one of several Continental companies engaged in the construction of Jodels.

The Jodel series, designed by MM. Joly and Delemontez, which began in 1948 with the single-seat D.9 Bébé-Jodel, now extends to the four-seat D.140, through the two-seat variants dating from the D.11 of 1950. An extraordinary number of Jodel sub-types with many different engines have been produced, mainly by amateur constructors, for whom the angular wooden airframe is relatively simple to build. From the 75/65-b.h.p. two-seat D.111 and D.112 have been developed the 90-b.h.p. D.117 and D.120, built commercially by S.A.N. and Wassmer respectively.

Both types are powered by the Continental C90-14F engine developing 95 b.h.p. at 2,625 r.p.m., and differ only in minor details. Their production in the past year or two has brought the total number of Jodels flying in France to well over 600, apart from additional construction under licence in Germany, Italy and Spain. With substantial State aid, the Jodel D.117 costs the French flying clubs little more than the equivalent of £1,000, but the U.K. price, including duty and radio, is still very reasonable at about £2,500.

Rollasons' D.117 demonstrator, G-APOZ, was recently granted a validation of its French C. of A., and in between patches of the recent persistent fog, I was able to make several handling flights in it to and from Croydon. Despite its violently dihedralled wings, which are a legacy from the original Bébé-Jodel, the D.117 is an attractive and clean little aeroplane, with a spatted cantilever undercarriage and, in the case of G-APOZ, an excellent blue-and-white surface finish.

Primary instruments are provided in the cockpit of the Jodel D.117, which has a blue-tinted canopy. The high throttle position in G-APOZ is apparent in this view, which also shows the central spoiler lever, radio, etc.

Photographs copyright "The Aeroplane"

Resplendent in its blue and white finish, the spatted Jodel D.117 shows a French chic in sharp contrast with the murky suburbs of South London.

This colour scheme is repeated on the upholstery for the two side-by-side seats in the cockpit, which also has a blue-tinted windscreen and canopy. The necessity for ultra-violet filters is not overly noticeable in Britain, but in happier climates a useful reduction in glare is probably obtained. The blue tint is less apparent from inside the cockpit, and did not appear to worsen the already limited visibility when crawling up the free lane from Godstone to Croydon (probably, and unhappily, for the last time, since Ministerial obduracy bars club aircraft from the airport after December 31).

The D.117, in fact, offers very good all-round visibility, and the only possible criticism of the canopy concerns the rather flimsy upward-hinging doors. Like the windscreen, the doors have frames of narrow steel tubes with self-engaging catches on rear supporting struts which might prove difficult to handle in a strong wind. The locking handles are also rudimentary, probably in the interests of weight-saving, and there is a noticeable gap between the bottom of the door and the fuselage.

The cockpit is a snug fit for two fairly well-built individuals and is provided with dual flying controls. The short sticks are slightly unusual in being formed from a continuous U-shaped tube with a central pivot point, but feel quite comfortable to use. A sheet-metal fairing between the seats covers the stick attachment point and also part of the rudder cables which run along the centre of the cockpit.

As is often the case, I found the rudder pedals slightly too far away for complete comfort and this was particularly noticeable when using the toe brakes. The brake levers are between the port set of rudder pedals to which they are linked by cable so that extreme pedal travel also results in differential braking. Like the Emeraude, the Jodel has no parking brake, but the differential hydraulic units will hold the aircraft for a run-up on foot pressure.

Primary flight instruments are provided on the raised central panel, which also includes the tachometer and fuel gauge. The latter is a large-dialled multi-purpose indicator incorporating warning lights for generator charging and oil pressure (regrettably there is no gauge) in addition to fuel level, which is read from a double-graduated scale. The D.117 has two fuel tanks; under the front coaming is one with a capacity of 13 Imp. gal., while behind the seats is an auxiliary tank of 12 Imp. gal.

A fuel cock on the right of the panel selects both tank and gauge reading, and the total tankage of 25 gal. gives the D.117 an extremely long operating range of more than 700 miles. Full fuel can be carried with two quite heavy adults on board and there is still room for a reasonable amount of luggage.

With only one other instrument—an oil-temperature gauge—the cockpit layout of the D.117 is very simple. A row of knobs on the left-hand side of the panel control cabin heat, engine starting, master switch, mixture and carburetter heat, while on the right are fuel and priming cocks, and circuit breakers. An excellent 12-channel French VHF set is mounted below the centre panel, with provision for intercom, but its location

presumably accounts for the plunger-type throttle lever in G-APOZ being installed right at the top of the cockpit dashboard, where it is awkward to use. It should be possible without too much trouble to restore the throttle lever to its former and more natural position in other D.117s below the centre panel.

Because of the absence of a parking brake the toe brakes must be applied the whole time during engine starting and warming-up on tarmac. A vigorous pull on the starter cable handle brings the Continental to life after two or three primes. The steerable tailwheel makes the use of brakes unnecessary when taxi-ing, except for tight turns, and the rubber-in-compression undercarriage gives a firm and well-damped ride.

Vital actions are confined to selecting slight tail-down trim, by rotating a tiny knob on the port cockpit wall in the appropriate direction; switching to the main fuel tank; and ensuring that the underwing spoilers of the D.117 are retracted. The simplicity of the Jodel "amateur-construction" conception excludes trailing-edge flaps from its design, but the S.A.N. D.117 has a two-position spoiler operated by direct manual linkage from a lever in the centre of the cockpit to give a useful increase in drag and steepen the glide.

As the airframe of the D.117 is so clean aerodynamically, the spoilers are essential for small-field performance, but of course unlike flap, they cannot be used to assist take-off. Fortunately, the unstick and climb-away performance of the D.117 are so good that this is of little consequence.

On opening the throttle to the maximum power of about 2,500 r.p.m., a little right rudder is needed to keep straight, and slight forward movement of the stick will raise the tail. Unstick occurs at under 40 m.p.h. after a run of less than two hundred yards, and the climb-out is steep at 70 m.p.h. When flying solo with full fuel I timed the climb to 1,000 ft. as 1 min. 20 sec., or about 750 ft./min., which is well above most ultra-light figures. I even got out of Fair Oaks going uphill

The effective underwing spoilers of the Jodel are shown here half-extended, which is sufficient for most normal landings.

in nil wind on soggy grass with the carburetter heat out, so that the D.117 obviously has power in hand.

Throttled back to economical cruising at 2,250 r.p.m. (63 b.h.p.), the D.117 settles down to a remarkable 115-120 m.p.h. I.A.S., at which the fuel consumption is only about 4½ g.p.h. Few are the sports cars that could return nearly 27 m.p.g. at such a cruising speed, and apart from rather more engine noise the Jodel is probably more comfortable than most comparable road vehicles.

From the handling viewpoint, the D.117 is equally good, with controls which remain effective and well co-ordinated throughout the wide speed range. The ailerons are possibly slightly heavier than one would expect from an ultra-light, but then the D.117 does not officially fall within this weight and power category. Stability conforms to the usual pattern, the absence of fixed fin area not being particularly apparent in that respect, but being so small, the Jodel is naturally fairly susceptible to turbulent air.

There is no reason, however, with such a cruising performance that the D.117 pilot should not climb to smooth air at the optimum height for the Continental of about 7,000 ft., except when thick cloud or very strong headwinds are encountered. Use of the mixture control should improve still further on the economy, and the long range makes a cruise-climb well worth while.

Firm application of the ailerons results in a rapid rate of roll, and Biancotto, the aerobatic champion, has taken the D.117 completely round a roll, which speaks well for the strength factors (+3.3 and −0.6 at max. a.u.w.). Never-exceed speed is 156 m.p.h. For normal turns, little or no rudder is needed, and the aircraft can be flown "feet-off" most of the time.

The little trim wheel is sensitive and quite powerful, but the changes of trim with power or speed are small. Some time was spent in flying the D.117 at lower airspeeds, to formate on a Tiger Moth, and while the engine was slightly rough, being sensitive to the maintenance of correct carburetter intake temperatures, the flight controls remained pleasant throughout.

As speed was reduced still further for stalls to be performed, with full carburetter heat as the throttle was closed, the Jodel lost speed quite slowly with increasing aft stick movement. It reached a startling angle, and the airspeed almost vanished off the clock at about 25 m.p.h. I.A.S. before with a slight tremor, the nose and port wing dropped gently. Lateral control appeared to remain throughout, and the loss of height to regain flying speed was negligible.

With the spoilers extended half way and a little power, the D.117 achieved an even more alarming angle before at roughly the same very low airspeed, similar stall symptoms followed a brief warning buffet. Position error must be substantial at that end of the airspeed scale, but the minimum flying speed must still be as low as about 35 m.p.h. I could not select full spoiler in the air, partly because of the restriction on personal movement by the shoulder-loop extensions of the lap-strap harness and partly through the increased air resistance preventing easy engagement as the lever is moved fully aft. The half-way position, however, is ample for all normal flying and spoiler movement probably does not greatly affect the stall.

Applying half-spoiler below 75 m.p.h. on base leg with a trickle of power results in a comfortably steep approach, which can be trimmed to about 55-60 m.p.h. by an anti-clockwise twist of the knob. In calm air, the speed can be further reduced on finals to about 50 m.p.h., but a 10 m.p.h. margin gives a brief float in more turbulent conditions. The elevator remains very effective during the round-out, and only slight stick movement aft of the central position is needed for a three-point landing. It is therefore easy to touch down tail-wheel first, but the Jodel shows no tendency to bounce and runs straight with little assistance.

Several trips in G-APOZ convinced me that the D.117 is a real touring aeroplane and not simply a toy for circuits. Although scaled down dimensionally in design, it has a performance comparable to, if not better than, many bigger aircraft, with considerably improved economy. Its initial cost appears to be sufficiently low to make it an attractive proposition for clubs, who could at last offer some really cheap flying in a modern and comfortable aeroplane.

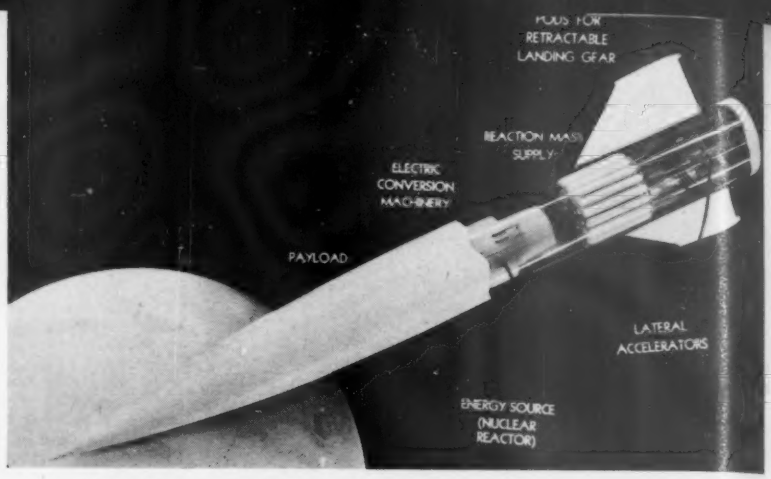
Leading Particulars

DIMENSIONS.—Span, 27 ft.; length, 20 ft. 2½ in.; height, 6 ft. 9 in.; wing area 136.7 sq. ft.

WEIGHTS.—Empty (including radio), 735 lb.; pilot, 200 lb.; fuel 174 lb.; useful load, 248 lb.; max. gross, 1,357 lb.

PERFORMANCE.—Max. speed, 130 m.p.h.; economical cruise, 120 m.p.h.; stalling speed, 31 m.p.h.; initial climb, 750 ft./min.; ceiling, 16,400 ft.; take-off run, 395 ft.; landing run, 425 ft.; max. range at 5,000 ft. in still air with 20 min. reserve, 725 miles.

Transatlantic Astronautics on Show



A Westinghouse model of an ion-propelled missile showing locations of the ion-rocket propulsion system.

A LARGE number of interesting exhibits at the recent Astronautical Exhibition, organized by the American Rocket Society in New York, has thrown some additional light on current research and project work being done in this field in the U.S. For example, the Arcas sounding rocket developed by the Atlantic Research Corpn., Alexandria, Va., made its first public appearance. Developed for the U.S. Navy under sponsorship of the Bureau of Ordnance and the Naval Research Laboratory, the Arcas was recently fired for the first time at White Sands Proving Site.

It is intended for use as an expendable vehicle to collect weather data as well as for research purposes, and is 7 ft. long and 4½ in. in diameter. Designed to carry a 12-lb. payload to 40-mile altitudes, separating its payload at altitude, the Arcas is launched from a lightweight, portable launcher which, it is claimed, can be assembled in the field by two men in 2 hr. The launch angle can be varied through a 20° vertical cone. Thrust for the Arcas is presumably a solid-propellent rocket but as it is "classified" information is not available.

First public announcement was also made at the Exhibition of the successful firing of the company's Arcon, a 12-ft. long, 6-in. diameter rocket designed to carry a 40-lb. instrument payload to a height of 70 miles, or a 10-lb. payload to 100 miles. A third rocket, the Iris, designed to carry a 100-lb. payload 200 miles high, is in an advanced stage of development, with completion planned early next year.

For more than two years the Grumman Aircraft Engineering Corpn. has been actively, but quietly, engaged in an integrated guided-missile effort. They now report that they have devoted more than 156,000 man-hours, 600 hr. of wind-tunnel testing and 500 hr. of automatic computing time in preparation of design and advanced-study proposals.

During 1957 Grumman design and study proposals were submitted to the Bureau of Aeronautics, Bureau of Ordnance, the U.S.A.F. and the Army. They included air-to-air missiles having improved guidance, aerodynamic and propulsive system characteristics; air-to-surface missiles of the stand-off strike type; target drones, with particular emphasis on manufacturing techniques and low-cost production; and advanced studies covering reconnaissance vehicles, missile application to anti-submarine warfare, and certain specialized techniques.

A number of Grumman wind-tunnel missile models were shown in New York for the first time. They included three wingless configurations typical of hypersonic missiles employing body lift for manœuvring capability and body flare for stability. A tail-first missile model shown was said to be an attempt to obtain maximum simplicity by selecting a configuration having Mach-number characteristics conducive to inherent speed stabilization. Discrete values of Mach number and altitude were desired for a given combination of fore-plane setting and thrust level, thus eliminating the need for guidance and minimizing stabilization requirements.

This model is of an ion-rocket being developed by the Rocketdyne Division of North American Aviation. In the centre is the propellent tank; at the top are the control box and insulators, at the bottom the focusing and accelerating electrodes.

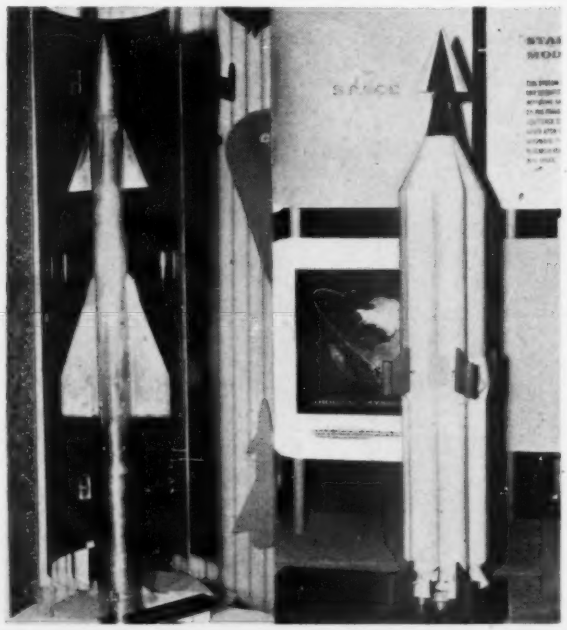
Howard Levy photographs

Another Grumman missile study has been a rocket-powered cruciform missile with very low aspect ratio wings and interdigitated tail surfaces; solid-propellent boosters would be used. The company also undertook a study of a two-stage solid-propellent missile with the second stage consisting of a rocket-powered cruciform missile with canard control surfaces having a delta planform.

North American Aviation's Rocketdyne Division "unveiled" a full-scale model of their new ion propulsion rocket engine. This prototype ion rocket has a length of 11½ in., a diameter of 8 in., and develops ¼-lb. thrust. It is to be bench-tested on a special test stand in about a month. The unit comprises a control box; stand-off insulators; propellent tank and boiler; diffusion chamber with diffusion plates to obtain uniform distribution of propellent vapour (Caesium vapour); focusing electrodes through which ions are discharged; and accelerating electrodes which set up a field to give the ions a high velocity.

Boeing were showing for the first time a 4-ft. model of a "Start" space vehicle designed to carry a two-man crew. This possibly represented the beginning of the DynaSoar project. It was described as a research tool to obtain knowledge of high-speed flight "on the fringes of space." A clustered solid-propellent boost system was chosen because it could be based on "low-cost, readily available hardware."

Convair were exhibiting a model of an Atlas manned space station. They believe that an experimental vehicle of this sort carrying four men could be established in a permanent orbit 400 miles above the Earth within five years, using the Atlas ICBM.—HOWARD LEVY.



Left, a wind-tunnel model by Grumman of a two-stage solid-propellent missile. Right, Boeing exhibited this "Start" model of a space vehicle designed to carry two men, possibly connected with the DynaSoar project.

TAKE LEAVE OF YOUR FRIENDS——

Some thoughts on Paxmanship by "TINNITUS"

I DON'T KNOW whether IATA has a rude meaning, in Greek or anything else. I have no intention of being rude to IATA, anyway; but having accumulated about 2,800 airline passenger hours and fastened my lap-strap 970 times in the past few years—paid to endure it, naturally—I am probably well entitled to fill up one of those personal *pro formæ*, addressed in a persuasively personal way to Juan Trippe or Eddie Rickenbacker, which invite the passenger to criticize, compliment and suggest. But I never have. Perhaps I lack the moral courage to hand the damning document unsealed to the

stewardess who has just been telling me all about her nice flat in Kensington. So here is a collective one, public, anonymous—and paid for by the Editor. I deserve it.

In 1944 our army in Normandy was given the title of British West European Force—B.W.E.F. The troops quickly made this Burma When Europe's Finished, a version considered demoralizing by the top brass, who substituted British Liberation Army. In 24 hours this became Bother Liberating Anybody, and the War Office gave up. At about this time, in theatres farther afield, B.O.A.C. was known as Blighters Overseas Avoiding Conscription; a name which wasn't improved upon until the early post-War years when the Corporation, limping along with Lancastrians and Yorks, earned the new interpretation of Better On A Camel, or just plain BOAT. Since October 3, 1958, I think we might elevate them to Beats Optimistic American Competitors.

These widely circulated but rarely published versions of airline titles often have a pleasant little touch of the *mot juste* about them. Teeny Weeny Airline touches a raw spot and delights Pan Am, whereas the alternative Try Walking Across is funny but unfair. Some are so natural as to invite invention, like Swizzair and Aer Fungus, or the widely used Fair Chance. Since in my experience Air France are the World's most punctual airline, as well as being statistically safer than most, this must be just a small echo of the tendency of some French captains to wear their caps at an angle and to shave after landing rather than before take-off. French logic? *Certainement. Vive le sport!*

Nevertheless, Air France are the only airline who have ever failed to weigh my baggage (alas)—in Saigon in 1953, if Mr. Hymans wants to know—and once in Teheran I returned to my seat after a fuelling stop to find the remains of an egg I had accidentally decanted on to the seat cushion still waiting for me, instead of the virginal impeccability most cabin cleaners usually achieve however jungly they may look themselves. On the credit side, Air France once gave me some superb cheese; when I asked what it was, the stewardess quickly produced a slip of paper with the supplier's address and Paris telephone number. Efficient indeed, but frustrating. Imagine being given a Paris telephone number in the Orly circuit by a pretty girl—for cheese.

What is the World's best airline, from the passenger's point of view (which should include some engineering judgment, as well as a Martini palate)? The short list is a long one and in the cabin standards can vary substantially from crew to crew. In this respect the smaller airlines have the opportunity to achieve a more even standard, with their smaller numbers of crews, than is possible on the P.A.A. or B.O.A.C. scale.

A few years ago I would have given Qantas the crown, largely for the consistency of their excellence. They also share with a few others the good fortune of an accident-free record. (I remember sitting on the airport veranda at Djakarta, watching a Qantas 749 embarking its passengers and trying to think of an interpretation of Qantas, after a Dutchman had defined K.L.M. as Kleine Lonen Maatschappij (Small Wages Company); K.N.I.L.M. (if you remember them) as Kalan Naik Ini Lekas Mati, which is Indonesian for "He who rides, dies"; and their modern successors Garuda Indonesian Airways as Golly I'm Airborne. An English charter pilot at the table suddenly spluttered into his Bols and solved the problem with Quells Any Nice Thoughts About Survival.)

Today the ratings seem to have changed; Qantas standards may have suffered a little in the big expansion in their scale of operations, but more probably it is just that other airlines have caught up. B.O.A.C., forced by the withdrawal of the Comet Is to operate uncompetitive aircraft, responded by a dramatic improvement in catering services, so that today their trolley-service for food and drinks is impeccable and far ahead of the majority who still use those horrid trays with seven dents for seven so-called courses.

When these standards are translated to first-class aircraft like the Britannia and the Comet 4 an almost unbeatable level of passenger appeal results; though one has heard it said that the slightly toffee-nosed air sometimes built into the B.O.A.C. stewardesses by their mummies and daddies in Cheltenham and elsewhere is a slight deterrent to non-European passengers, who think it is some kind of racial superiority complex. Hence, perhaps, the great success of Japanese, Chinese and Indian stewardesses on B.O.A.C.'s Eastern routes. The easy bounce and mateyness of K.L.M. and S.A.S. (Suck and See) is perhaps a little to be preferred for this reason, though I still recall the painful experience of listening to a heavy-humoured K.L.M. captain on the P.A. ponderously giving his load of travellers some nauseating patter about Father Neptune being too busy to notice us as so many giant K.L.M. planes are crossing the Equator today. Steward! Cotton-wool, please.

Public-address systems seem to lag far behind the general efficiency of modern aircraft, with their inevitable distortions and screeches and heavy breathing noises. Ignorance of the correct use of a microphone by the cabin staff is probably more to blame than the equipment itself, and B.O.A.C. offend in this respect. They should listen to the Hawaiian music which fills the cabins of Pan Am Stratocruisers during the let down into Honolulu, or the test-match commentaries with which Qantas enrage American tourists. And isn't the cabin roof the best place for the loud-speakers? The passenger ahead of the bulkhead in the Comet 4 has one blasting into his ear.

But if any operator still manages to hold a clear lead in a very competitive race, I think it is Canadian Pacific Airlines; Constant Prayer Advisable, as they are described in rival hangars. Their route mileage is big, but in atmosphere and in their tight-knit compact organization they retain the spirit and virtues of a small airline. In the cabin staff their cosmopolitan collection of Dutch, Danish, French, English and others (doubtless looted quite ruthlessly from the national airlines who trained them!) give easily the best service that I have experienced.

The other C.P.A. is Cathay Pacific, the British independent operating out of Hong Kong in a Far East regional network and wringing 4,000 hr. a year from DC-6s. For years C.P.A. operated one DC-4 with tourist-class fares and first-class food —but it was always roast chicken. They were the one-aircraft-

one-chicken airline. Today, with Electras on order, they are expanding and flourishing in the face of fierce competition. Their time-table claim to be a "British airline with British pilots" may pull in traffic but being a bit of an insult by implication is perhaps a mistake on the whole. I have also noticed a tendency sometimes to conduct the lifejacket drill in English and skip the Chinese version. Are they better swimmers?

Pan American do not deserve their Pan Demonium World Scareways label; they are quite calm and subdued, especially by American standards. I think they are supreme in one field—on the ground. (And, more recently, on Madison Avenue.) They handle delays admirably; the station manager invariably struggles out of the swimming pool and comes to the airport to hand out apologies in person; they send off free cables to one's destination and months after one has forgotten the whole thing a handsome bug-letter arrives and makes one cross all over again. Pan Am also send a real live American to help one through Customs and Immigration instead of a well-meaning local national who, because of the language difficulty, only half understands the passenger's problem of getting a tape-recorder out of bond or changing his last handful of pesetas.

In the air they do a fine job of presenting the AWOL although the classlessness of U.S. society has the advantage that their cabin crew all have an air of possible Harvard or Vassar. They also announce themselves in a dreadfully democratic way such as "Your hostess is Mary-Lou Punfkt. Mary-Lou will now point out the amenities." Miss Punfkt, please, Juan. We haven't been introduced.

This Mr. Maxim must be a busy chap. Every day he simultaneously loads limp salad at Leopoldville, buffalo steak at Bangkok, *suki-yaki* in Tokyo, and all with the *cachet* and pong of the Rue Royale. There must be hundreds of Mr. Maxims, can-opening and defrosting night and day all over the globe, come to think of it. And that sophisticated Pan Am cellar. As ubiquitous as Coca-Cola, the St. Julien 1947 bobs up everywhere, in every climate and at all altitudes. I suppose it's all right for those born in the same year as the brew—and, of course, that nice couple from Split Lip, Arkansas. But still, a favourite airline, bless them. Smoke and all.

One wonders why there is a sharp contrast between the rather rugged transcontinental ride by Trans-Canada Airlines (Thrashing Crossover Argonauts, as it used to be) and the excellence of their transatlantic service. Could competition be the answer? If Canadian Pacific win their coming battle for transcontinental rights, we shall quickly find out.

Aeroflot—Aeroflop, naturally—are a standing example of the Sixth Freedom: Freedom from Competition. The Tu-104 certainly provides the speed, which is the essence, but the service is a grisly comradely version of what the West can do. Try a 3-a.m. refuelling halt at Irkutsk, with the temperature minus 40 and a bitter Siberian wind. Do we race in a luxury coach to a steam-heated terminal? NO. We lurch around the aircraft on a sheet of ice, kicking the tyres and peering up the jet pipe until *rigor mortis* sets in, when we hastily climb back inside, while an elderly Bowser continues to bestow its trickle over the wings. Still, any airline that feeds you about ten pounds' worth of caviare is a good one for my money even if the cabin is a snake-pit of oxygen tubes.

Yet competition can be a menace as well as a stimulant for the operating industry—the $50 high-ball approach, as one American operator described the difference between first and tourist. Having decided to sample the much-advertised Silver Wing lunch on the B.E.A. London-Paris service I deprived myself of a morning in Paris by taking the midday departure and settled expectantly into the rearmost seat of my Elizabethan to wait for the caviare, orchids and gipsy music. Before we were clear of the airport boundary I felt a small firm hand on my shoulder and there was the stewardess, balanced on one foot to change her four-inch heels and saying in my ear, "You've got to put your rubbers on to feed this lot in one hour ten." But we got our seven-course tray, even if the champagne was served after the coffee.

The average traveller I believe prefers the airline to assert its competitive spirit in secondary ways, such as the Pan Am ground service already mentioned, rather than in the almost agricultural intensity of the effort to cram into the victim more liquid and solid calories than anyone else. The handling of delays, for instance. B.O.A.C. do this very well usually, although success depends as much on the personality of the station manager as anything else. The utter misery of drinking a succession of lemonades in a hot airport lounge while the time of departure is put back hour by hour until one finally falls into a coma must, of course, be weighed with the cost of an unnecessary overnight delay, with hotel bills and all the snowball consequences of a mispositioned aircraft.

Against this must be set the other snowball—of ill-will and criticism. People like to tell tales of their heroic sufferings in Darwin or Kano long after they have lost interest in the pleasant recollections of their travels. There is, therefore, probably a lot of hidden value in the quick decision to delay for 12 or 24 hours. The passengers then get an unexpected glimpse of a new country, a couple of hours of "temple-bashing," a swim and finally a happy hour in the local night-club complete with at least one warm pink gin with a hair in it generously provided by the airline. And let the excuses be true ones; the steward or the engineer officer usually lets the cat out eventually in any case. It is not good, for Bristol or anyone, to blame a Britannia delay on "maintenance" when the real cause is the expiry of the crew's continuous-duty period. (If only someone could publish exact delay statistics for the Super Constellation and Britannia, the favourable truth about the maligned Lingering Giant would surely become apparent.)

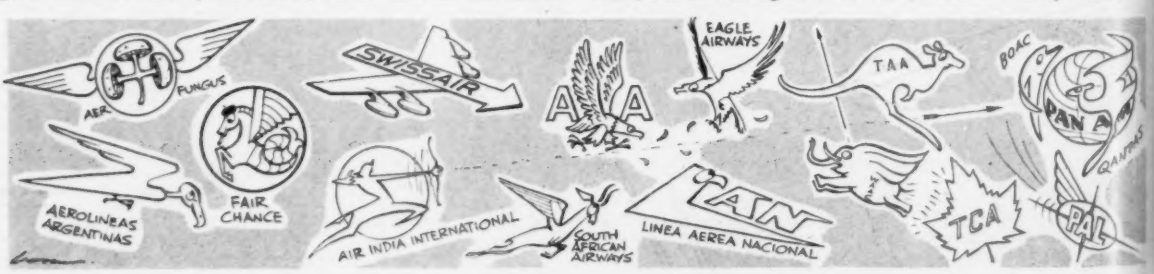
Already the Britannia is the most tempting aeroplane in general service despite the temporary disadvantage of being the first new-generation aircraft to inflict the six-abreast treatment (where one always sits between two Marcianos and never two Monroes). Its main appeal comes not from comfort as such but from speed. Most will agree that air travel is hell; therefore elapsed time is a real criterion and a saving of 20% on a long journey to San Francisco or Tokyo is a matchless benefit. The brochures may indeed emphasize that one "sits motionless in space," but who wants to sit motionless in anything for 30 hours without a change of shirt?

So the Comet is better still. Today it enjoys a temporary, and let us hope quite protracted, supremacy. But its appeal lies in its superiority over propeller types; the intrinsic quietness, speed and even exhilaration of jet flight. The test will lie in public comparisons with 707s, DC-8s, 880s and Caravelles. Early evidence is not discouraging for the Comet seems to be at least as quiet as the 707; it has the great advantage of no more than four-abreast first-class: and its superior thrust-weight ratio gives a sense of more effortless flight which even the passengers can recognize.

It is a pity that the interior of the Comet 4 is not more imaginative. One could wish for a breath-catching styling and an originality in detail to underline dramatic performance.

Comet performance wrapped around the cabin arrangements of an Air India 1049G or a Japan Air Lines DC-7 would set a standard indeed. It is, in fact, said that B.O.A.C. have given the Comet 4 the best galley ever designed, but the other little room is a disaster. Somebody must be able to design a curtain that pulls, a table that can be persuaded out of its slots in a few seconds and a coat hook so positioned that your coat can be hung upon it.

In reality, as the industry's highly developed passenger relations organization well knows, load factors do not hang on coat hooks. They hang on a host of nebulous emotions and impressions among which coat-hook design is but a small formative agent. There is frequency of service, the manners of the city-centre coach driver, the O.P. Jones-ness of the captain, the bit of egg between the prongs of an hermetically wrapped fork, the inadvertent heavy landing, the disarming charm of errors in English ("Please pass forward to the rear"), passengers who talk or scratch in the middle of the night, and of course, a mountain of accumulated prejudice. I know a man who fell out of a sleeper on South African Airways and broke his leg. He blames the South African Railways, Douglas, Wright, and Haig and Haig, in that order. I don't know how the airlines put up with us. I don't know how we put up with them; but I'm off again on Tuesday. Fasten Safety Belts!



Remembering a Pioneer Operator

WEARING their robes the Master and Court of the Guild of Air Pilots and Air Navigators of the City of London took part in the ceremonial unveiling of a memorial window in the Baltic Mercantile and Shipping Exchange on December 11. The window, portraying the coat of arms of the Guild in colours, was unveiled by Mrs. Instone, whose husband, the late Captain Alfred Instone, had presented it to the Guild. It is perhaps proper to recall here that the first Continental service of S. Instone and Co., Ltd., left Hounslow civil aerodrome on October 13, 1919, as duly recorded in Capt. Instone's book "Early Birds."

The new window has the distinction of being the first architectural feature in the Exchange linked with its newest activity, the Air Charter Market, which incidentally is not so new, seeing the first "party" was signed in 1928.

Speeches were made by the Master of G.A.P.A.N., Sir Frederick Tymms, by Mrs. Instone and by the chairman of the Exchange, Mr. R. D. Hyde. The ceremony was honoured by the presence of the Masters of the Master Mariners and of the Shipwrights Companies.

With the modest pride of the newcomer in the presence of the great, SIR FREDERICK TYMMS said the Guild was proud to place its arms alongside those of the Master Mariners and of the Shipwrights and of the Farmers Companies. Since the first Air Charter Party negotiated through the Exchange in 1928 the business of the Air Market has grown until some 60 air transport operators from all parts of the World are represented through air brokers on the floor of the Exchange. Sir Frederick reminded his hearers that the air charter activities of the Baltic are now marked by the wings appearing on its coat of arms.

In his speech of acceptance, MR. R. D. HYDE paid tribute to the late Captain Alfred Instone both as a pioneer of air transport and as an enthusiastic member of City companies.

Photographs copyright "The Aeroplane"

BALTIC CEREMONY.—Air charters are arranged in the Baltic Mercantile and Shipping Exchange in the City of London. Here on December 11 a window (above) was unveiled by Mrs. Instone who, seated on Sir Frederick Tymms' left is listening to Mr. Denis Hyde, chairman of the Baltic, accepting the window as a memorial to the late Captain Alfred nstone.

Napier Apprentices

ALWAYS an enjoyable aeronautical event, the annual presentation of indentures and awards to Napier apprentices, gained added lustre this year from the recent celebration of the 150th anniversary of the company's founding. And to mark the occasion Acton Town Hall was chosen as the imposing setting, on December 11, for the ceremony.

Sir Miles Thomas, D.F.C., M.I.Mech E., M.S.A.E., the guest speaker, in his capacity as chairman of the governing body of Brunel College, gave the apprentices a most stimulating address.

He urged them never to refuse advice—but never to follow it unquestioningly. "If you want to get ahead," he said, "ask questions and above all keep the little word 'why' in full employment." History, he added, is full of men who made a name by doing things that "couldn't be done" and there is room for plenty more of them. "Don't be satisfied with a steady income, a modest home, an uneventful life," he said, "look for something better and don't rely on other people to find it for you."

In his annual report, Mr. J. F. A. Radford, A.I.Mech.E., chief of personnel and training, recorded that the total number of Napier apprentices under training during the year was 348. During the year under review 98 apprentices in various grades completed their training. He reported 64% examination successes—compared with the national average of 35%.

Merit awards (cash vouchers) were presented to 127 apprentices by the Mayor of Acton, Alderman C. T. Higgins.

Indentures were presented to the apprentices by Mr. W. E. Lewis, M.B.E., the works manager. Sir John Paget, Bart., M.A., M.I.Mech.E., M.I.P.E., the general manager, presented certificates of service and certificates of merit.

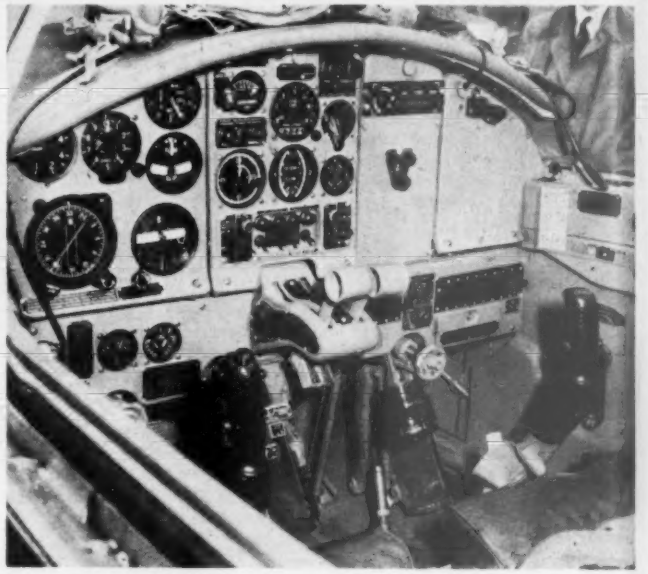
The prize for the best trade apprentice went to M. E. Jackson and was presented to him by Mr. W. J. Baxter, the works superintendent. The Foremen's Trophy and Prize was presented by Mr. W. Wallace, senior foreman of the investment foundry, to T. Smyth with R. Chamberlain as runner-up. A new award this year was the Technicians Trophy and Prize—this went to J. Yeoman and the runner-up was H. Davis; these awards were presented by Mr. W. G. Read, the chief draughtsman. Finally, the Company's Trophy and Prize to the best student apprentice went to G. Evans, with R. Clark as runner-up; these presentations were by Mr. H. G. Nelson, M.A., M.Inst.C.E., M.I.Mech.E., M.I.E.E., managing director of the English Electric Company, who warmly thanked Sir Miles Thomas for his inspiring address. He congratulated Mr. Radford on the fine year's work reported.

Below, left, Sir Miles Thomas addresses the Napier apprentices at their annual prizegiving on December 11. Below, right, the principal prizewinners were (left to right) M. E. Jackson (Best Trade Apprentice); T. Smyth, (Foremen's Trophy); J. Yeoman (Technicians Trophy); and G. Evans (Company's Trophy).

Cranfield's New Jet Classroom

Photographs copyright "The Aeroplane"

Flt. Lt. J. A. Macdonald and Sqn. Ldr. I. A. Robertson.



NEWEST piece of educational equipment for the College of Aeronautics, a Morane-Saulnier M.S. 760 Paris, arrived at Cranfield from Villacoublay on December 10 with visibility on the ground of 500 yd. and a ceiling of 150 ft. Talk down was achieved by "super-teamsmanship" between the two pilots, Sqn. Ldr. I. A. Robertson and Flt. Lt. J. A. Macdonald; the two controllers at Cranfield, and the radar team at R.A.E. Bedford, who transmitted their information by landline.

The four-seat Paris, which has a loaded weight of 3,375 kg. (7,435 lb.) carries 950 litres (210 Imp. gal.) of fuel. With two 880-lb. thrust Turboméca Marboré II engines, it cruises at 350 m.p.h. at 16,400 ft.

Commercial Aviation Affairs

(*Continued from page* 882)

MANDATORY NAVAIDS. — From May 1, 1959, aircraft using the U.K. airways must carry a VOR receiver in addition to ADF and VHF capable of receiving marker-beacon signals (or Decca or Gee in the areas served). For the time being this VOR requirement will not be applicable to aircraft flying only in control zones and within uncontrolled airspace, or to those using the advisory service. Sixteen VOR stations are to be available in the U.K.; four of these are now operational and four more will be operational during or before May, 1959.

FIRST IMPRESSION.—Two Turboméca Bastan turboprops are to provide the power for the S.E.118 Diplomate 8-10 seat executive and light transport aircraft.

SEPTEMBER TRAFFIC.—U.K. airlines offered 15.6% more capacity ton miles in September, 1958 (compared with September, 1957) and traffic increased by 7%. Passenger traffic decreased by 1.6%, but passenger miles increased by 8.2%. B.O.A.C. traffic on Western services was up by 39.1%, but decreased by 5.7% on Eastern services.

FALCON AIRWAYS.—Falcon Airways has been registered as a private company to acquire the business of the same name owned by Independent Air Travel. The capital is £10,000 in £1 shares.

ANTARCTIC ALTERNATIVE.—Construction of an airstrip at Wilkes in the Australian sector of Antarctica has been advocated in the Australian Parliament. This would open up an alternative route between Johannesburg and Melbourne, avoiding the Indian Ocean crossing via Cocos Island and Mauritius.

IATA MEETINGS.—Venue of the next IATA general assembly will be Tokyo, from October 12 to 16, 1959. The 1960 meeting will be in Copenhagen in September, with S.A.S. as the host airline. It is proposed that the assembly shall meet in Australia in 1961 and Ireland in 1962. The Spring Conference of the IATA Traffic Conferences will be held in Europe in mid-May, under the chairmanship of Mr. V. H. L. Dubourcq of K.L.M. The fall meeting will take place in Honolulu under Mr. H. B. Renwick of C.P.A.L.

PREPARING FOR THE COMET.—Sixteen Aerolineas Argentinas aircrew have completed a seven weeks' ground-training course on the Comet at Hatfield. Flying training will be completed from Buenos Aires when the first Comet 4 is delivered in February.

ANOTHER FOR AER LINGUS.—On December 11 the third of seven Fokker F.27 Friendships was delivered to Aer Lingus and ferried to Dublin.

CZECH PLANS.—Czechoslovak Airlines is buying several Ilyushin Il-18s from Russia for service next year. The Czech-designed Morava five-seat taxi will be used on internal routes and the HC-2 helicopter is going into service as a light transport.

ELECTRA DELIVERY.—American Airlines' first Electra was delivered from Burbank to Fort Worth International Airport on December 5 preparatory to the introduction of Electra service between New York and Chicago on January 23.

COMET DELIVERIES.—The fifth Comet for B.O.A.C. (and the second built at Chester), registration G-APDH, was delivered to London Airport on December 6, nearly two months ahead of schedule. The next Comet, G-APDF, was rolled-out at Hatfield early in December.

EDWARD WARNER AWARD.—ICAO has created an Edward Warner Award—named after Dr. Warner, president of the council of the organization from 1945 to 1957—to be presented, in the form of a gold medal, to a non-commercial institution or individual for "outstanding contributions to the development of international civil aviation." Mr. Walter Binaghi, president of the council, is chairman of the award committee.

PIPER'S LATEST.—Although it has many components used in other Piper models, the PA-25 Pawnee has been specially built for agricultural purposes. It has a 150-h.p. Lycoming engine.

SWEDISH SAFETY RULES.—New traffic rules will take effect in Sweden on January 1 to reduce the risk of collisions. All traffic flying airways above 3,000 ft. must be IFR and new minima will apply for VFR flying off airways. Military radar stations are to be used for civil air traffic control.

FERIHEGY EXTENSION. — The main runway at Ferihegy Airport, Budapest, has been extended by about 2,000 ft. to a length of 9,975 ft. New landing aids and communications equipment from Britain and Russia is being installed.

News About People

SAro CHANGES.—Mr. W. Browning (above, left) has relinquished his post as general manager of Saunders-Roe, Ltd., and has become deputy chairman of Saunders-Roe (Anglesey), Ltd., Saro Laminated Wood Products, Ltd., and Saro Structures, Ltd. Mr. H. W. D. Winkworth (right) has been appointed works director of Saunders-Roe, Ltd.

GOODYEAR POST.—Mr. Martin G. Foulger has been appointed manager of the Aviation Products Division of the Goodyear Tyre and Rubber Co. (Great Britain), Ltd., in succession to Mr. C. D. Heckman.

STEEL APPOINTMENT.—Mr. W. E. A. Redfearn has been elected a director of the English Steel Corpn., Ltd., as from January 1, 1959. He has been associated with the Corporation and its predecessors since 1915, and is deputy managing director of the English Steel Forge and Engineering Corpn., Ltd., and a director of the English Steel Rolling Corpn., Ltd.

H.S. RESIGNATION.—Mr. G. C. R. Eley, C.B.E., is to resign from the board of the Hawker Siddeley Group at the end of this year. He recently joined Richard Thomas and Baldwins, Ltd., as deputy chairman, with the intention that he should succeed Sir Ernest Lever as chairman next April.

FOLLAND ENTERTAINS. — Fifty companies in the aircraft industry were represented at the fourth annual dinner and dance of the supplies department of Folland Aircraft, Ltd., at Southampton, on December 4. Principal hosts were Mr. W. E. W. Petter, managing director and chief engineer, and Mr. A. F. Rock, chief supplies officer. Also present was the company's test-pilot team led by Sqn. Ldr. E. A. Tennant. Guests included Wg. Cdr. "Sandy" Powell, aircraft sales manager of Automotive Products. The toast to the supplies department was proposed by Mr. Brian Songhurst, managing director of Serco, Ltd., who said that the function did much to improve relations.

B.O.A.C. APPOINTMENTS. — Mr. H. J. (Ray) Bingham has been appointed B.O.A.C. manager, Middle East, in Beirut. He was formerly manager, San Francisco, where he is succeeded by Mr. R. W. I. Geldard. Mr. John Dodd has been appointed manager, Chicago, in succession to Mr. Geldard; he was previously station manager at Montego Bay, Jamaica.

AVIATION INSURANCE.—Mr. L. Murray-Stewart, who has been underwriter and manager of the Aviation and General Insurance Co., Ltd., since its incorporation, is to retire on December 31. Mr. C. R. Jeffs is to succeed him in these posts, and Mr. P. E. Mortimer, who is approaching retiring age, will continue as assistant underwriter.

B.O.A.C. FLIGHT MANAGERS.—Capt. T. B. Stoney has now taken up his appointment as B.O.A.C. flight manager, Boeing 707s. His former deputy, Capt. R. E. Millichap, succeeds him as flight manager, Comets, and Capt. E. J. N. Hengle has been appointed deputy flight manager, Comets.

BROUGH VISITORS.—Seen at Blackburn and General Aircraft, Ltd., recently were Col. R. W. McDuffee, assistant U.S. air attaché (second left) and Maj. D. L. Kennedy, technical assistant to the attaché. With them here are Capt. E. D. G. Lewin (extreme left), and Gp. Capt. S. Wroath (right).

ROTORPORTS DIRECTOR.—Mr. H. M. Berney, A.A.I., A.A.L.P.A., has been appointed a director of Rotorports, Ltd., and will be responsible for property and development interests.

AERO GOLF.—The dinner and annual general meeting of the Aero Golfing Society were held at the R.Ae.C. on December 5, and the following officers were elected for 1959: president, Lord Brabazon of Tara; vice-president, Sir Frederick Handley Page; captain, P. L. W. Morton; vice-captain, R. L. Lickley; committee, C. F. Boyes, W. J. Shilcock, R. E. Hardingham, P. W. S. Bulman, J. E. Waite and J. G. Drummond; honorary secretary, V. C. Varcoe.

AIRCRAFT EMPLOYMENT. — In September people employed in "the manufacture and repair of aircraft" numbered 247,500, according to the Ministry of Labour. This compares with 258,800 in September, 1957. The first month during which the level of peace-time employment rose above the September, 1958, figure was December, 1955.

Military Aviation Affairs

TARGET CANBERRAS.—An undisclosed number of Canberra U.10s are to be used at Woomera as missile targets to supplement Jindiviks and Meteor U.15s and 16s already in service. Technical staff from the Weapons Research Establishment, South Australia, and R.A.A.F. aircrew have been stationed at Short Brothers and Harland, Belfast, throughout the development of the aircraft. The first target Canberra, flown by a R.A.A.F. crew, left the U.K. for Australia on November 25.

G.91 PROGRESS.—The international experimental squadron, with pilots and ground crews from France, W. Germany, Greece, Italy and Turkey to undertake tactical trials with the Fiat G.91, has been formed in Italy and will eventually operate with the Allied Land Forces in Central Europe. The Fiat G.91, which was selected as the first-generation NATO tactical fighter, has been ordered by the German Luftwaffe, which is to have 50 direct from Italy, plus another 150 manufactured in Germany under licence.

GERMAN SAMs.—The West German Army is to be equipped with both Nike-Hercules and Nike-Ajax SAMs. A ratio of one-third Hercules to two-thirds Ajax is expected and both missiles will be used in conjunction with the Lockheed F-104 Starfighter ordered by the W. German A.F. The training of 150 German officers and men in the techniques of using both missiles has already started in the U.S.

FINAL PARADE.—Nineteen Commonwealth Wirraways at R.A.A.F. Point Cook before the recent flypast over Melbourne to mark the trainer's withdrawal from regular service. Operated by the R.A.A.F. for 19 years, the Wirraway has been replaced by the D.H. Vampire T.33 and T.35.

IRAQI MiGs.—According to recent Press reports, Iraq has received several shipments of Russian arms, including MiG jet fighters. Other MiGs of the United Arab Republic have been flying since the Iraqi coup from Habbaniyah, where 600 R.A.F. personnel are still virtually confined to the domestic site of the airfield.

SICILIAN AIR BASE.—Work is in progress near Catania, Eastern Sicily, on a large combined U.S.A.F./U.S.N. air and naval base. The airfield will have a 15,000-ft. runway.

TWIN PIONEER.—The Portuguese representatives of Scottish Aviation gave demonstration flights of the Twin Pioneer to Portuguese Army officials in Lisbon on December 9.

THE "INDEPENDENCIA." — The Argentina carrier "Independencia" (formerly H.M.S. "Warrior") left for Buenos Aires on December 10 following trials in the English Channel. The commissioning of the carrier was completed in eight weeks.

AUSTRALIAN TRANSPORTS.—The first five Lockheed C-130 Hercules transports for the R.A.A.F. arrived at Richmond, near Sydney, on December 13. R.A.A.F. crews are seen with the transports before take-off from the manufacturers' Marietta plant.

Private Flying

H.J.C.'s CLUB COMMENTARY

● PRAISE for the Currie Wot ultra-light biplane, recently built by members of the **Hampshire Aeroplane Club** at Eastleigh was expressed by Mr. Harold Best-Devereux, P.F.A. chairman, when he spoke at the club's annual dinner at Ampfield. He said that it is a delightful aeroplane, and that great credit is due to Mr. Joe Currie, who designed it 20 years ago.

Mr. Best-Devereux proposed the toast to the Hampshire club. Response was made by Mr. John Dykes who, after some wartime reminiscences said, "I like to think that the great spirit of comradeship, enterprise and initiative which existed at Eastleigh then still shows itself in the club today. It is still in the same clubhouse, and has the same enthusiasm for flying."

Mr. R. J. Stranger, M.C., who welcomed the guests, criticized the decision of the M.T.C.A. not to lay down a hard runway at Eastleigh because of their estimate of the cost, and because of proposed railway development on the northern boundary. "Eastleigh airport," he said, "is perhaps the most tragic example of the amalgamation of the Ministries of Transport and Civil Aviation; in this area undoubtedly civil aviation plays second fiddle to the railways."

Replying to the welcome, Mr. Maurice Imray expressed bitterness about the Ministry's closing of Croydon; the R.Ae.C. had objected to this move and fought hard to keep it open. "We just have not got from the Ministry a policy which will help us in any way," he continued, "but we are going to fight to support your sort of flying and all it stands for."

Mr. Owen Hill, the club chairman, presided. After the speeches Mr. Harold Feltham presented a bouquet from members to Mrs. V. H. Bellamy, wife of the club's manager.

● IN RECOGNITION of his 10 years of work as honorary secretary of the **Popular Flying Association**, Mr. Maurice O. Imray was presented with an inscribed wallet on December 9 by Mr. Harold Best-Devereux, the present working chairman of the P.F.A. The occasion was the first "beer and bangers" evening held at the Kronfeld Club, when many members of the P.F.A. and B.G.A. were present.

RECOGNITION. — Mr. Maurice Imray (right) receives from Mr. Harold Best-Devereux a gift of appreciation for his 10 years' work for the Popular Flying Association.

Mr. Imray said that it was a quite unexpected gift, for which he was very grateful; he had tried to act in the spirit of the movement over this period, which was in effect that the members of the Association had to help themselves.

Mrs. Imray was presented with a bouquet of flowers; the poodle "Maximillian," though active and ubiquitous, did not receive any just reward.

Although this club was founded to provide a London centre for gliding and power-flying pilots there has been a tendency for it to become almost exclusively a gliding centre. This is not the fault of the gliding community, and it is difficult to understand why more P.F.A. group members, who have frequently expressed a wish for such a centre, do not make more use of this attractive and friendly club.

● FIVE MONTHS ago the A.B.A.C.-affiliated **Air Touring Club** came into being at Croydon, primarily for holders of P.P.L.s who want to go on for their C.P.L.s, although some *ab initio* instruction is also given. There are about 10 flying members, and 50 social members. An Autocrat, G-AHHS, is operated; instruction is provided at £3 an hour. Members pay 2s. 6d. annual subscription and there is an entry fee of £1. During the past months members have made about 20 training flights to the Continent.

The C.F.I. is Mr. Edgar Adams, formerly of the now-defunct Pioneer Flying Group. Mr. C. B. Carter is the chairman, the secretary is Mr. B. R. Cleary, and the treasurer, Mr. J. H. Williams.

IN THE SOUTH-EAST.—Miss Valerie Sampson, 21, of Lexden, near Colchester, is learning to fly with the East Anglian Flying Club at Ipswich. With her is her instructor, Mr. Stanley Ward.

● A LOW TOTAL of 191 hr. was recorded by the **Fair Oaks Aero Club** in November, which is not surprising, even for that club, when one considers what the weather has been. All the same, Messrs. Turpie, Crouch, Jeffree and Wordsworth got their P.P.L.s, and two members—Messrs. Coyle and Oliver—flew solo.

The Christmas gathering previously announced for December 14 will now be held on December 20.

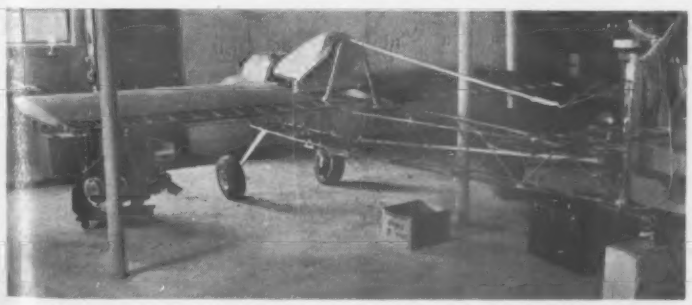
(*Continued on page* 914)

Cassutt's New Racer

THIS is the first photograph of Tom Cassutt's partially built Model 2 (racing number 11), shown in the basement workshop of his Huntington, N.Y., home.

Following the basic configuration of his previous No. 111, he has gone to the other extreme of wing thickness—a very thin one as compared to the 6-in. thickness of No. 111. Aerofoil thickness is only 3½ in. and the wing is built with a double spruce spar (another of Cassutt's innovations) and covered with three-ply, 45°-grain mahogany. Carved balsa tips weighing but ¼ lb. each complete the streamlining. The fuselage is of chromemoly 4130 steel with metal forward and fabric aft of the cabin. The canopy is an Aeronca unit cut in halves (Cassutt gives Bill Falck credit for that idea), and an interesting formed fuel tank of 15 3/10-gal. capacity is installed behind the firewall. Designed to a safety factor of 12 *g*., No. 11 has a wing span of 13 ft. 8 in. and a constant chord of 58 in. Length is 16 ft., height at the canopy 3 ft. 10 in. and the height of the rudder but 2 ft. Full-span ailerons are fitted Empty weight is 475 lb. and gross weight 750 lb. Although expected to be faster than No. 111, the new craft will land at about 60 m.p.h.

Cassutt also intends to put out plans on a sports version of a composite No. 11/No. 111 using an aerofoil which will give it a landing speed slightly more than 50 m.p.h., with a 180-200 m.p.h. top speed on 65-90 h.p. engines—HOWARD LEVY.



CROYDON CLOSE-UP.—Club flying is due to end at Croydon Airport, the scene of so much British civil aviation, on December 31. This picture of a D.H. Tiger Moth of the Surrey Flying Club is a fitting tribute to the work which the clubs have done there.

(*Continued from page* 913)

● LEARNED FRIENDS at the Bar, following the precedent of the other "Bar" clubs for tennis and yachting and so on, have formed the **Bar Flying Club,** open to barristers associated with and interested in flying, many of whom are already members of existing flying clubs. The chairman is Mr. Christopher Shawcross, Q.C., well known as the joint author of "Air Law" and a founder-member of the Oxford University Air Squadron. Acting as secretary is Mr. Lionel Thompson, a former R.A.F. bomber pilot.

● I SEEM to have incurred the wrath of members of the **Denham Flying Club** by a statement in our issue of December 5 that flying rates had been increased by 10s. an hour. In fact this increase is not yet in force, and will not be made until the proposed cuts in petrol-tax grants take place, one next year and the other in 1959.

● THE NEW C.F.I. of the **Elstree Flying Club,** Eddie Wild, is aged 26, and learnt to fly after gaining an A.T.C. scholarship. He has been an instructor at Elstree for some time, before which he was a draughtsman with Helliwell's at Birmingham. He has flown about 1,500 hr.

The Elstree club now has a fourth Chipmunk, G-APOE, and a fifth is expected in the spring.

The next C.P.L. course at Elstree will begin in February.

Gliding Notes

by Dr. A. E. Slater

A METHOD of regaining control in clouds, if one has the misfortune to get into a high-speed spiral dive, is described by B. H. Carmichael in *The Thermal*, official organ of the Southern California Soaring Association. It was actually invented by Ray Parker, whose instructions he followed.

Parker's advice is: "You must, before you panic, ensure that you will not pull back on the stick and tighten up the spiral. Take your other arm and place your fist so as to jamb the stick motion at the neutral location. Now try moving the stick to one side. If you speed up, immediately reverse the lateral stick motion and you will slow down. Try to kick it into a spin when slowed down."

One day, Carmichael was in urgent need of this advice, for he was tempted into a huge cumulus cloud over the Sedco Hills in his home-built Schweizer 1-26. Eventually he ran into turbulence; there was "almost dead stillness" followed by increasing airspeed, so he instinctively pulled the stick back, and there he was in the dreaded spiral dive. However, he remembered Ray Parker's instructions, and they worked. The same thing happened three times, and still they worked; but on the first two occasions he pushed the stick to the wrong side at first, making the wind scream louder than ever, before he quickly reversed it. Finally, having slowed the machine down for the third time, he pulled hard back, put on full rudder and emerged safely from cloud base in an ordinary spin.

* * *

IN ADDITION to a duty instructor appointed for each flying day, Cambridge University Gliding Club will have a "duty engineer," who will not only see that all the mechanical equipment is serviceable, but will appoint the necessary people to work it, as well as organizing "working parties" if necessary.

Another innovation by the mechanical subcommittee is the appointment of specialist "project chasers" to advise on how best to do various jobs waiting to be done; there are 22 of these, for which 16 "chasers" have been allotted and six more volunteers are wanted.

* * *

"WINGTIPS," the Midland Gliding Club's bulletin, reveals that the "advisory route" airway which crosses the Long Mynd has had its base raised to 5,000 ft., but as this is only 3,500 ft. above the Mynd, cloud flying is still virtually prevented, and efforts to get the route moved are still without result.

The club is proposing to double the number of its gliding camps, open to non-members, next year. This time, in addition to accepting those who only come in order to learn gliding, a different kind of camper is to be catered for too. This is the sort of person who primarily wants a country holiday in an attractive situation, but would also like to put in some passenger flights on gliders when the weather is suitable, without wanting to learn to fly solo (or so the visitor thinks, before being bitten).

A Midland club member who visited the American gliding centre at Elmira, N.Y., describes how he went up in a Schweizer 2-22 with one of the instructors, climbed rapidly to 4,000 ft., and was told: "I have never seen anyone hold onto a thermal like that . . . you should enter for our Nationals!" He then proceeded to show the instructor how to loop a glider, the latter having never done it before.

Few people, he says, do any gliding in the eastern United States, and he attributes this to the restrictions on cross-country flying and the consequent lack of publicity. I receive regularly a bulletin produced by the South Jersey Soaring Society, which operates from an airfield at Hillville, has about 17 active members, and in the first 10 months this year put in 77¼ hr. from 403 launches in a two-seat Pratt-Read and a privately owned Schweizer 1-26. They catch plenty of thermals, but rarely fly away from the site. As to the area they serve, their most distant members live 85 miles away in Maryland. This appears to be the only gliding club catering for the eight-million population of New York.

THE M.I.T. (Massachusetts Institute of Technology) Soaring Club claims to be the oldest continuously active soaring club in the Western Hemisphere, with a history "probably" going back to "about" 1910. But its formal name is "Aeronautical Engineering Society," and there is no record of any soaring in America before about 1928, apart from that conducted by the Wright brothers. They were making glider flights of up to 2 min. in 1902, but this duration was first exceeded on October 24, 1911, by Orville Wright and a British visitor, Alec Ogilvie, at Kitty Hawk, the longest flight being 9¾ min. by Orville.

In the Old World we have a flight of 59 sec., with a height gain of about 100 ft. by E. C. Gordon England at Amberley Down in 1909, and in the same year a soaring flight by Raymond Hekking in Brittany, alleged to have lasted 5 min. but not properly authenticated. The magazine *Thermik*, celebrating the 65th birthday of Dr. Friedrich Wenk, reminds us that a tailless machine designed by him made the first authenticated soaring flight in Germany in 1920 over the Feldberg in the Black Forest, but does not mention that the pilot was Herr Peschkes, and that he soared for 2 min. along a beat 2 km. long in a wind of 20 m.p.h.

* * *

AN Autogiro without a motor is, presumably, of interest to gliding people. Igor Bensen, in the United States, has designed and marketed one called the Gyro Glider, which is stated to have a sinking rate of 16 ft./sec. in still air. As thermals of this strength are fairly frequent, it should be able to soar.

So far, however, it is only allowed to be flown on tow, so that it can be classified as a kite, which requires no C. of A. It needs a ground run of up to 1,000 ft. to get the rotor turning fast enough, and will then take-off at 25 m.p.h. airspeed. There must, of course, be enough runway left for slowing down gradually.

It is rather remarkable that, according to *Soaring*, in four years the number of Gyro Gliders bought or home-built has exceeded the total number of registered sailplanes in the country, and "thousands of sets of plans have been sold."

Correspondence

MACships and Escort Carriers

IN CASE nobody else has done so, I think I should point out that the article "Naval Aviation's Background" in your excellent special Fleet Air Arm issue of November 28 is rather ambiguous about an historical point which is not clearly made in Owen Thetford's book, "British Naval Aircraft, 1912-58," nor in several other published references about the F.A.A. in the Second World War. Quite erroneous is the implication that "Merchant Aircraft Carriers" (MACships) were escort carriers.

Although both types of ship derived from H.M.S. "Audacity," the captured German merchantman "Hanover" which was converted into an aircraft carrier in 1941, the MACship was, in fact, quite distinct from the escort carrier. Escort carriers—of which the Royal Navy had about 50 at the end of the War—were, of course, proper warships—albeit built on what were basically hulls originally designed for merchant use—which embarked operational squadrons equipped with many types of naval aircraft.

MACships, on the other hand, were analogous to CAMships—"Catapult Aircraft Merchant ships"—and were grain ships or tankers which continued to act as merchantmen while also carrying aircraft for convoy-protection duties. The CAMships carried Hurricane fighters which were launched by catapult to defend convoys against air attack. The MACships, in a rather similar way, carried usually four Swordfish for anti-submarine work. The Swordfish were flown from, and landed back on, rudimentary flight decks mounted on these specially-modified merchantmen, of which I believe there were about eight—including "Empire McColl," "Empire MacAlpine," "Empire McAndrew" and "Empire McRae." The MACships had no hangars and their aircraft, when not flying, had to be carried continuously exposed on deck.

The Swordfish embarked in MACships were provided and crewed by two special squadrons, Nos. 836 and 860. They did a remarkable job which has never received the publicity it deserves. This work was, however, quite distinct from that of the squadrons—many of them also equipped with Swordfish—which operated from the far more numerous escort carriers.

Ruislip, Middx. PETER W. BROOKS.

Hydro Espresso

I ENCLOSE a photograph of a "Siamese-Solent" being made at Poole. It comprises the hulls of Solents formerly kept on the harbour in the Wareham channel, site of the War-time

Sunderland base at Hamworthy. "City of Liverpool," G-AKNS, and "Solway," G-AHIU, are to be joined by a box girder at wing and tail roots. They will retain all the existing fittings, galley, etc., and be linked together via a corridor. It is proposed to tow the "S.S. Coffee Bar" to London or any suitable estuary site.

Surbiton, Surrey. JOHN GAYLARD.

Open to All

PLEASED as I was to see a report of the Kronfeld Club's activities in your issue of November 21, I have been taken to task by some of the members, as this report appears under the heading of "Gliding Notes." Ever since the idea of the club was first discussed in May, 1955, we have always held the view that we are open to members from flying clubs and P.F.A. groups and gliding clubs. In fact, the objects of the club as stated in the rules are "the furtherment of gliding and light aircraft flying." It has always been disappointing that more powered aircraft types do not make use of the club, as it can provide a common meeting ground for two types of flying enthusiasts, both of whom would benefit from the interchange of ideas.

Although the present membership is predominantly drawn from gliding clubs we would be happy to have an equal "power" and "powerless" membership.

HUGO TROTTER,
Hon. Secretary, The Kronfeld Club.
74 Eccleston Square (Basement), London, S.W.1.

Groundabout

The Potent Press. On January 11, 1957, this magazine printed the accompanying drawing as subtle propaganda in aid of the College of Aeronautics' crusade to acquire a jet-propelled classroom as a logical extension of the work done by the Dove. Now, two years later, their Dept. of Flight has received a twin-jet Morane-Saulnier Paris. You see how powerful is the Press! But seriously and as a

matter of interest, I believe this is the first French aeroplane to be bought by this country since the 1914-18 War. (See also p. 909.)

*

Food for thought. At an entertaining session this columnist had with Boeing chief of flight test "Tex" Johnston and P.R.O. Gordon Williams, the subjects ranged widely. Mention of the old Boeing 314 flying-boat led to regrets over the passing of Aquila's Madeira boats because of sea-swell, and the idea of tunnelling runways in that island's mountains. On swift flying, Gordon proposed Time-pills for adjusting stomachs to local meal-times. We went on to the ultimate transportation, the transmutation of matter, and agreed that even then there would be those who would want a scotch and soda in transit.

*

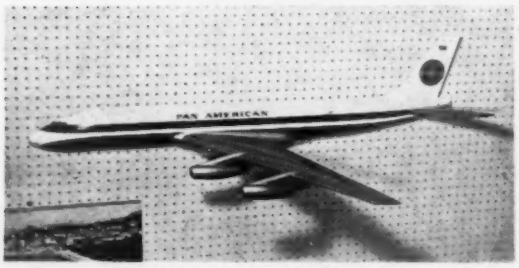
Airy Humour. "Tex" Johnston proved to be like most test pilots—dedicated to flying and with a sense of humour. Before he joined Boeing ten years ago he was with Bell and while flying their P-59A Airacomet, America's first turbojet, he drew up alongside a propeller-driven fighter, having stuck into his mouth one of the cigars he is partial to. Then the steam-driven pilot looked round and saw a propellerless fighter being flown by a cigarful pilot. I recall seeing a picture somewhere of D.H.'s Pat Fillingham flying a Hornet fighter with a bowler. Pat, not the Hornet.

*

Wren's Commendation (Christmas Honours List) is awarded to the de Havilland company for Attaching a Wrapper to their December D.H. Gazette to Keep the Back Page Jokes Clean.

by Gwen

NOTES AND EVENTS



IN MINIATURE.—Half-shell display models of the Douglas DC-8 are being made by Westway Models, Ltd., for Pan American Airways. They are 3 ft. long and are entirely vacuum-formed in Bextrene-toughened polystyrene sheet, a product of BX Plastics, Ltd., of Chingford, London, E.4.

PLESSEY CONNECTORS. — Two ranges of high-temperature plugs and sockets have been produced by the Plessey Co., Ltd., of Ilford. These connectors, which are improved designs of the company's aluminium Mk.4 and standard ranges of plugs and sockets, have been introduced to meet the demand for higher working temperatures.

COMPUTER EXHIBITION.—Nearly 40,000 people from 41 countries visited the Electronic Computer Exhibition and Business Computer Symposium, which closed at Olympia on December 4. One of the last orders was for a £50,000 Hollerith computer installation for Hunting Aviation.

PRODUCTION CONFERENCE. — Theme of the seventh annual conference on aircraft production organized by the Southampton Section of the Institution of Production Engineers is to be "The Aircraft Industry—A National Asset." The Conference will be at Southampton on April 16-17, 1959.

AIRCRAFT FILTERS.—Palmer Aero Products, Ltd., is now manufacturing the aircraft filters developed by Parmatic Engineering, Ltd., of Canada. These are stated to have a normal operating temperature range of −55°C. to +200°C.; an operation pressure of up to 6,000 p.s.i. and a variable degree of filtration. They are suitable for a wide range of fluids.

CHANGE OF ADDRESS. — The London offices of the Metropolitan-Vickers Electrical Co., Ltd., have been moved to 33 Grosvenor Place, S.W.1. (Tel., Belgravia 7011.)

MELTING FURNACES. — A new company—Birlec-Efco (Melting), Ltd., of Westgate, Aldridge, Staffs—has been formed by Birlec, Ltd., and Efco, Ltd., for the design and supply of all types of electric melting furnace. These include vacuum furnaces for the non-ferrous metals industries.

SPARTAN SURVEY.—The aerial survey of half of Mozambique, Portuguese East Africa, is being done by Spartan Air Services, Ltd., of Ottawa, using a modified DC-3. The work covers both photo-mapping at 25,000 ft. and ground-profile recording, using radar altimeter equipment in the aircraft. Spartan Air Services (Eastern), Ltd., of Nairobi, Kenya, a subsidiary of the Canadian company, will be responsible for the developing and printing of the photography and the compilation of the airborne profile records for mapping purposes. This company has started a photo-mapping survey of Somalia, East Africa, for a Canadian mining concern.

NEXT YEAR.—The 16th annual Radio and Electronic Component Show organized by the Radio and Electronic Component Manufacturers' Federation, will be held at Grosvenor House and Park Lane House, London, W.1, from April 6 to 9. Admission is by invitation only and applications for tickets should be made to the secretary, R.E.C.M.F., 21 Tothill Street, London, S.W.1.

FLEXFLYTE DUCTING. — Avica Equipment, Ltd., of Hemel Hempstead, Herts, has supplemented its standard Flexflyte tubing ranges and other products such as stainless-steel bellows and flexible pipe-lines with silicone rubber components. Flexflyte air ducting was described in THE AEROPLANE of March 14, 1958.

RUBBER DEVELOPMENT.—Since introducing Prescollan polyurethane rubber in 1955, Precision Rubbers, Ltd., of Bagworth, Leicester, has improved its processing technique and the material now covers a wider range of applications. These include seals, gear wheels, diaphragms, etc.

PROTECTION FENDERS. — The Goodyear Tyre and Rubber Co., Ltd., has developed a protection fender for preventing damage to vehicles and equipment. It consists of an extruded D-section of white abrasion rubber mounted on a nickel-plated strap.

INDUSTRIAL TRACTOR.—Wessex Industries (Poole), Ltd. of Poole, Dorset, has introduced the Wrigley industrial electric tractor. Powered by a 48-V. DC motor, it will haul a 10-ton load at 3-4 m.p.h.

NEW PRODUCT.—S. Crowther (Royton), Ltd., of Royton, Lancs, is manufacturing a range of double acting hydraulic cylinders. With a maximum working pressure of 1,500 p.s.i. and stroke sizes of 4, 10, 20 and 30 in., the cylinders have a maximum thrust of 18,850 lb., and a maximum pull of 14,150 lb.

Company Notice

NEW COMPANY

Skycraft Services, Ltd. (17,233).—Private co. Reg. in Dublin on Nov. 4. Cap £10,000 in £1 shs. Objects: To carry on the business of aircraft operators, agents and brokers, carriers of freight and passengers, aerial advertising and aerial photography, etc. Subscribers (each with one sh.): Jocelyn I. Yates, 56 Lower Mount St., Dublin; Oliver G. Fry, 14 Lower Mount St., Dublin, solicitor. Jocelyn I. Yates and Margaret D. Yates are first directors.

Aviation Calendar

December 31. — Kronfeld Club, New Year's Eve Party, at 74 Eccleston Square, **London,** S.W.1.

1959

January 1.—R.Ae.S. Belfast Branch lecture, "Bird Flight," by J. Barlee, in lecture hall LG8, David Keir Building, Queen's University, **Belfast,** at 19.00 hrs.

January 3.—British Interplanetary Society lecture "Rocket Combustion Research with Liquid Propellent Engines," by D. S. Carton (College of Aeronautics), at Caxton Hall, Caxton Street, **London,** S.W.1, at 18.00 hrs.

January 5. — R.Ae.S. Derby Branch, A.G.M. and 10-min. papers, at the Rolls-Royce Welfare Hall, Nightingale Road, **Derby,** at 18.15 hrs.

January 6.—R.Ae.S. Young People's Lecture, "Rocket Flight in Space," by Dr. L. R. Shepherd, at the Royal Society of Arts, 6 John Adam Street, **London,** W.C.2, at 15.00 hrs.

January 6. — R.Ae.S. Luton Branch lecture, "Flight-testing of Modern Prototype Aircraft," by C. F. Bethwaite (A. V. Roe), in the Napier senior staff canteen, **Luton Airport,** at 18.15 hrs.

January 6. — R.Ae.S. London Airport Branch, film show, at B.E.A.'s Viking Centre Cinema, Hatton Cross, **London Airport,** at 18.00 hrs.

January 7.—R.Ae.S. Brough Branch lecture, "The Tyne Turbo-propeller Engine," by D. McClean (assistant chief designer, Rolls-Royce), in the lecture hall, Electricity Offices, Ferensway, **Hull,** at 19.30 hrs.

January 7.—R.Ae.S. Southampton Branch lecture, "Modern Aircraft Maintenance Procedure and Techniques," by A. G. Nunn (senior planning engineer, B.O.A.C.) in the Institute of Education, University of **Southampton,** at 20.00 hrs.

January 7.—R.Ae.S. Reading Branch lecture, "Interplanetary Flight," by J. E. Simpson, in the Palmer Hall, West Street, **Reading,** at 19.30 hrs.

January 7. — R.Ae.S. Bristol Branch, Brains Trust, at Filton House, **Bristol,** at 18.00 hrs.

January 7.—R.Ae.S. Weybridge Branch, Brains Trust, at the Apprentice Training School, Vickers-Armstrongs (Aircraft), Ltd., **Weybridge,** at 18.10 hrs.

New Patents

APPLICATIONS ACCEPTED

807,831.—Blackburn and General Aircraft, Ltd., Taylor, C. W., and Turner, S. M. M.—"Control surfaces provided with flaps and mechanisms for actuating the latter."—April 29, 1957.

807,917.—Sperry Gyroscope Co., Ltd.—"Control systems for aircraft."—July 12, 1956 (July 29, 1955). (Addition to 803,572.)

807,918.—Sperry Gyroscope Co., Ltd.—"Control systems for aircraft."—July 29, 1956 (July 29, 1955). (Addition to 803,572.)

Applications open to public inspection on Jan. 21, 1959; opposition period expires on April 21, 1959.

808,205.—Warnken, E. P.—"Prestressed blades of air-foil configuration and method of making same."—May 5, 1955 (May 5, 1954). (Addition to 802,157.)

Application open to public inspection on Jan. 28, 1959; opposition period expires on April 28, 1959.

Personal Notices

BIRTHS

Askham.—On Dec. 2, at R.A.F. Hospital, Akrotiri, Cyprus, to Shirley (*née* Gilder), wife of Flt. Lt. W. D. Askham—a daughter.

Blyth.—On Nov. 28, at R.A.F. Hospital, Halton, to Maureen (*née* Parker), wife of Sqn. Ldr. C. Blyth—a daughter.

Chambers.—On Dec. 3, at Kingston Hospital, to Joy (*née* Batty), wife of Wg. Cdr. E. Chambers, M.B.E.—a daughter.

Cornell.—On Nov. 28, at the Gors Hospital, Holyhead, to Maritta, wife of Sqn. Ldr. P. Cornell—a son.

Davis.—On Dec. 5, at R.A.F. Hospital, Cosford, to Elizabeth (*née* McAdam), wife of Flt. Lt. A. R. Davis—a daughter.

Fletcher.—On Dec. 2, at St. Richard's, Chichester, to Mabel (*née* Berry), wife of Flt. Lt. T. Fletcher—a son.

Leighton.—On Dec. 3, at R.A.F. Hospital, Akrotiri, Cyprus, to Florence, wife of Flg. Off. R. Leighton—a son.

Whiteley.—On Nov. 28, at Royal North Shore Hospital, Sydney, to Yvonne, wife of Gp. Capt. E. A. Whiteley (retd.)—a daughter.

MARRIAGE

Ayshford—Money.—On Nov. 19, in Vancouver, Wg. Cdr. J. M. Ayshford, of Thorpe Bay, Essex, to K. J. B. Money, of Vancouver.

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